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Surveillance Study of Control Equipped Heavy-Duty Gasoline Powered Vehicles

Southwest Research Inst, San Antonio, Tex

Prepared for

Environmental Protection Agency, Ann Arbor, Mich Div of Motor Vehicle Pollution Control

Oct 72

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SURVEILLANCE STUDY OF CONTROL EQUIPPED HEAVY-DUTY GASOLINE-POWERED VEHICLES

by
Melvin N. Ingalls
Karl J. Springer

INTERIM REPORT

Prepared for
Environmental Protection Agency
Office of Air Programs
Division of Motor Vehicle Pollution Control
Contract EHS 70-113

October 1972

SOUTHWEST RESEARCH INSTITUTE
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This interim report covers the results of the first year of exhaust emission tests on a group of 152 heavy-duty gasoline fueled 1970 and 1971 model year vehicles. Each of the trucks were tested at four month intervals using a chassis version of the heavy-duty gasoline nine-mode Federal Test Procedure. An additional group of ten truck engines were tested on both a stationary engine dynamometer as prescribed by the FTP and on a chassis dynamometer to determine the correlation between the 2 test methods. The first objective of the project, to determine the effectiveness of exhaust emission controls on new 1970 and 1971 trucks in actual operation, has been met. The results of the initial round of tests indicate that a majority of the trucks were within the 1970 Federal standards for HC emissions and that less than half were within the standards for CO emissions.

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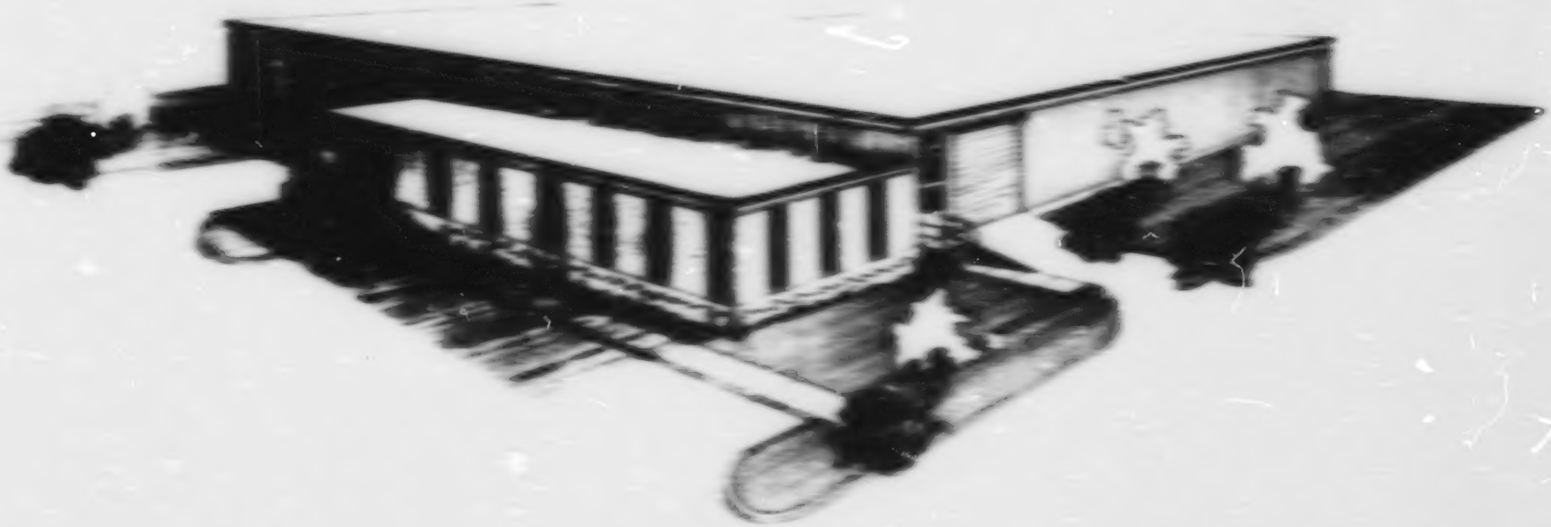

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SOUTHWEST RESEARCH INSTITUTE
Post Office Drawer 28510, 8500 Culebra Road
San Antonio, Texas 78284

Emissions Research Laboratory

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October 1972

Approved:

John M. Clark, Jr.
Technical Vice President
Department of Automotive Research

FOREWORD

This project was initiated by the Surveillance and Inspection Branch, Division of Motor Vehicle Pollution Control, Office of Air Programs of the Environmental Protection Agency, 2565 Plymouth Road, Ann Arbor, Michigan 48105. The engineering effort on which this report is based was accomplished by Southwest Research Institute, 8500 Culebra Road, San Antonio, Texas, under contract number EHS 70-113.

Mr. Karl J. Springer, Manager, Emissions Research Laboratory, Southwest Research Institute, was the Project Manager for this work. The principle engineers associated with this project were Mr. Melvin N. Ingalls and Mr. Clifford D. Tyree. The project began on June 23, 1970, with completion extended to February 28, 1974, by contract modification No. 2 of EHS 70-113 dated January 11, 1974.

The Project Officer cognizant of this project was Mr. Charles Domke, Chief, Surveillance and Inspection Branch, Division of Motor Vehicle Pollution Control, Air Pollution Control Office, Environmental Protection Agency, 2565 Plymouth Road, Ann Arbor, Michigan 48105. On August 4, 1972, Mr. John White of the Surveillance and Inspection Branch was appointed Project Officer, succeeding Mr. Domke. This project was identified within Southwest Research Institute as No. 11-2862-01.

ABSTRACT

This interim report covers the results of the first year of exhaust emission tests on a group of 152 heavy-duty gasoline-fueled 1970 and 1971 model year vehicles. Each of the trucks were tested at four month intervals using a chassis version of the heavy-duty gasoline nine-mode Federal Test Procedure. The exhaust emissions measured were hydrocarbons, carbon monoxide, and nitric oxide. An additional group of ten truck engines were tested on both a stationary engine dynamometer as prescribed by the Federal Test Procedure and on a chassis dynamometer to determine the correlation between the two test methods.

The correlation study showed that the exhaust emission results from the stationary and chassis dynamometer tests agreed within ±15 percent for the majority of the tests, though there was no one correlation factor for any engine or emission type.

The first objective of the project, to determine the effectiveness of exhaust emission controls on new 1970 and 1971 trucks in actual operation, has been met. The results of the initial round of tests indicate that a majority of the trucks were within the 1970 Federal standards for hydrocarbon exhaust emissions and that less than half of the trucks were within the Federal standards for carbon monoxide exhaust emissions. Federal standards are used as reference values for the entire fleet, although a chassis version of the engine dynamometer Federal certification procedure was used. At present, it is not possible to define a general trend of emission level changes with mileage. The changes that have been observed are small in magnitude and diverse in direction. The determination of emission level trends with the mileage, which is the second objective of the project, must await the completion of the remainder of the inspection rounds before definite conclusions can be drawn.

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I. INTRODUCTION

According to the latest statistical information(1)*, all trucks comprise about 16.6 percent (17,871,000) of the total vehicles registered and burn approximately 28.2 percent of the gasoline consumed in the United States. From sales data (1), approximately 42 percent of the trucks and buses sold are above 6,000-lb gross vehicle weight (GVW). This estimate includes diesel vehicles which are a relatively small number. Although there is less known about heavy duty vehicles (HDV) than light-duty vehicles (cars) in their role as contributors to the total air pollution problem, the Environmental Protection Agency (EPA) has sponsored a continuing long-range investigation of HDV emissions at Southwest Research Institute.

This interim report covers the progress of surveillance inspections of exhaust emission control equipped 1970-1971 heavy-duty vehicles. As it draws heavily on the knowledge and experience gained in previous HDV projects, a brief review of these projects is presented here.

A. Previous Projects

Southwest Research Institute's Emissions Research Laboratory has been privileged to have conducted a major portion of the research with HDVs beginning in June 1967. This first effort was the acquisition of baseline emissions data from 150 gasoline and LPG fueled spark-ignited engine-powered trucks and buses using three experimental road-like chassis dynamometer procedures. Exhaust emissions for this project were obtained using a special truck version of the constant volume sampler (CVS) which permitted expression of contaminants on a mass basis. The results of the survey are contained in the SwRI final report(2) which concluded that the three proposed experimental nonconstant speed cycles were not recommended for use in testing emissions from heavy-duty vehicles powered by spark-ignited engines. The findings of this study were summarized in AIChE and SAE papers(3, 4) which described the preparations and baseline data results, respectively.

The second major work in this continuing program compared hydrocarbon (HC), carbon monoxide (CO), and nitric oxide (NO) emissions obtained in actual road driving to chassis dynamometer emissions obtained using the Federal nine-mode constant speed cycle (FTP) for six trucks of various sizes and makes. Using a CVS, the current Federal cycle was subjected to a number of modifications to investigate what improvements might be made to make the Federal procedure agree more with road operation(5).

The third in this series of projects, sponsored by the Environmental Protection Agency, was completed in April, 1972. The first phase of this three-phase project was a broad emission characterization study of four 1969 trucks under a wide variety of engine speeds, power levels, and both stationary and chassis-operated engines. Emission rates of hydrocarbons, carbon monoxide, and nitric oxide were expressed in mass units of grams per minute, per pound of fuel and per bhp-hr. In addition to the steady-state emission maps, a number of transient accelerations and decelerations were studied using a variety of simulated vehicle inertias. The second phase was a four-vehicle study of the effect of four different road routes on emission rates. The road routes were sufficiently different to be distinct, yet were considered representative of actual truck driving. The final phase was a nine-truck evaluation of an experimental 23-mode test procedure using both stationary and chassis-operated engines. The three phases of this project generated a large body of data that is summarized in the report (6) and included in some detail in a number of appendices.

Beginning in January 1970, exhaust emission standards were set by the EPA at a level requiring some emission control devices (7). The need of the EPA for information regarding the effectiveness of these control devices in actual operation led to the surveillance activity covered in this report.

B. Scope

This report covers the first 12 months (4 inspection rounds) of operation of the surveillance fleet. The results discussed in the report are for the surveillance tests and stationary-to-chassis dynamometer comparison tests only. The results of work done under parts K and L of the Modified Scope of Work (CVS tests and Road Route studies) are covered in a separate report titled "Mass Emissions from Trucks Above 6,000 lb GVW-Gasoline Fueled", dated August 1974.

II. OBJECTIVE AND APPROACH

A. Objective

The objective of this project is to determine the effectiveness of exhaust controls on 1970 and 1971 heavy-duty gasoline trucks in the southwestern portion of the U. S. and to establish their performance versus operation (time) and mileage accumulation.

B. Approach

To meet the objectives of the project, a group of at least 140 vehicles were to be inspected periodically, measuring exhaust emissions of hydrocarbons, (HC), carbon monoxide (CO) and nitric oxide (NO) using a chassis dynamometer version of the 9-mode Federal Test Procedure (FTP) for gasoline fueled heavy-duty vehicles.

Vehicles in this program were to be chosen to represent, to the extent feasible, the total HDV population by make, displacement and application. While every effort would be made to use new vehicles, it was recognized that it would be necessary to include some vehicles that would have accumulated 10,000 miles prior to the start of testing.

Since the FTP is an engine test stand dynamometer procedure and the surveillance test uses a chassis dynamometer, a check of the correlation of the results from the two methods would be necessary. A group of 10 trucks would be tested using the nine-mode FTP on both chassis and stationary dynamometers and the results of the two types of tests compared.

C. Project Reviews

During the initial month of the project (July 1970), several conferences were held with the Project Officer regarding the extent of, and date for, instrumentation checkout, calibration, and validation. Such a correlation step was considered important to assure acceptable test results. The start of laboratory tests was delayed approximately 5 weeks by mutual agreement with the Project Officer, to permit calibration and correlation with the EPA (then NAPCA) dynamic calibrator. On September 8 and 9, 1970, Mr. Matt Macocha, Mr. Jim Marzen and Mr. Tom Lyttle visited the Emissions Research Laboratory for the purpose of checking the Laboratory exhaust gas analysis system against the NAPCA dynamic gas calibrator. The laboratory instrument results varied from the dynamic gas calibrator by more than an acceptable amount. This lack of agreement was subsequently found to be attributed to the combination of gas chromatagraph procedures in defining standard calibration gases and the use of high order polynomial equations to define the calibration curves. To facilitate agreement, on September 24 and 25, 1970, approximately 50 calibration cylinders were transported to the NAPCA laboratories for definition of concentration. Upon return of the cylinders to SwRI, new calibrations of each instrument were performed using the dynamic gas calibrator on November 2, 1970. These calibrations gave satisfactory correlation. The difficulties in correlation of the SwRI gas analysis instruments and the EPA dynamic gas calibrator set back the start of surveillance tests an additional month.

The several months delay in starting tests under this program resulted in 1971 model trucks becoming available. To fulfill the intent of this project, namely evaluation of emissions with low mileage, preferably factory new, as-delivered vehicles, clarification of contract wording was requested of the Project Officer. On November 23, 1970, approval was given to utilize 1971 model vehicles for purposes of this project.

On December 16, 1970, Mr. Karl Springer, Emissions Research Laboratory Manager, visited the Project Officer at the EPA's Ypsilanti Willow Run Laboratory for discussions of the project status and progress.

During the week of July 1971, Mr. M. Macocha of the EPA, visited the Emissions Research Laboratory to inspect and check the calibration of the Beckman NDIR instrumentation train. The only item found worthy of special mention was a small leak in the high level hydrocarbon system. The leak was located in a Swaglok tubing fitting near a solenoid valve and affected only the high hydrocarbon part of the system. The leak was assumed to have been the result of a solenoid inspection and cleaning several days before. No surveillance trucks had been tested in the intervening period, so that the leak had no effect on surveillance results. Some deficiencies in record keeping and data logging were noted and immediate changes were made by operating and supervisory personnel to meet the desires of the inspector.

A project review conference was held on February 14 and 15, 1972, at the Emissions Research Laboratory of SwRI. Personnel in attendance from the EPA were Messrs. Charles Domke and Jim Marsen of the Division of Motor Vehicle Pollution Control and Messrs. Jim Hammerle and David Kircher of the Division of Air Quality and Emission Data. Mr. Karl Springer, Manager of the Emissions Research Laboratory, hosted the meeting assisted by members of the Emissions Research Laboratory professional staff, including Messrs. John Storment, Clifford Tyree and Melvin Ingalls.

The project work and results to that date were reviewed and procedures for the work required in the recent contract revision were discussed. The specific item covered applicable to this part of the project was a decision to investigate the possibility of a detailed analysis of surveillance emission data on a percent change in emission level versus mileage basis and to ascertain cost and effectiveness of this type of analysis.

The equipment and procedures used for the chassis version of the Federal nine-mode heavy-duty test procedure were observed during an actual surveillance test.

Mr. Tom Bejina of the Surveillance and Inspection Branch, Division of Motor Vehicle Pollution Control, Environmental Protection Agency, visited the Emissions Laboratory on June 13 and 14, 1972, to review the project, check test and calibration procedures, and discuss EPA recommendations and requirements for instrumentation calibrations. It is our understanding that the procedures for both truck testing instrumentation and calibration were satisfactory. Several recommendations were made for improvements in instrumentation calibration procedures which were implemented.

III. TEST FACILITY, EQUIPMENT AND PROCEDURE

A. Test Facility

With the exception of the first inspection round, all surveillance tests have been conducted at the new SwRI Emissions Research Laboratory. This laboratory, shown on the frontispiece, was placed in operation in April, 1971, and is equipped for controlled-environment operations with the most modern means of emissions sampling and analysis.

The chassis dynamometer used for gasoline surveillance is housed in one of the laboratory high bay areas. There is ample room in this area to accomodate all instruments and the largest truck in the surveillance fleet. Figure 1 is a picture of the surveillance test area. The approximately 100 tons of air conditioning and heating are capable of maintaining the laboratory high bay area at 70°F to 75°F over the entire range of outside ambient temperature experienced in the area. Some summer humidity control is obtained with atmospheric water removal in the air conditioning system, but no other humidity control is attempted.

The stationary engine dynamometer used in the stationary-to-chassis dynamometer correlation tests was housed in test cell 3 of the U.S. Army Fuel and Lubricants Laboratory at SwRI. This laboratory is a completely equipped engine test facility run by SwRI for the U.S. Army. Figure 2 shows pictures of the control stand and test cell area of test cell 3.

B. Test Equipment and Instrumentation

1. Exhaust Sampling and Analysis

For the surveillance tests, gas sampling and analysis for the nine-mode FTP was accomplished using the system shown in Figure 3. This system includes a gas sampling and analysis train using Beckman non-dispersive infrared (NDIR) gas analyzers in a Beckman-built sampling system and a Data General Super Nova Computer with the necessary peripheral equipment for automatic data acquisition and processing. The NDIR sampling train meets the requirements and specifications established in the Federal regulations(7) for heavy-duty vehicle exhaust sampling. For convenience, the portions of the Federal regulations applicable to exhaust emission testing of heavy-duty gasoline vehicles, as printed in the Federal Register are reproduced in Appendix C. A flow diagram and component discription of the system is contained in this Appendix. Nominal full-scale concentration levels for the five NDIR analyzers are as follows:

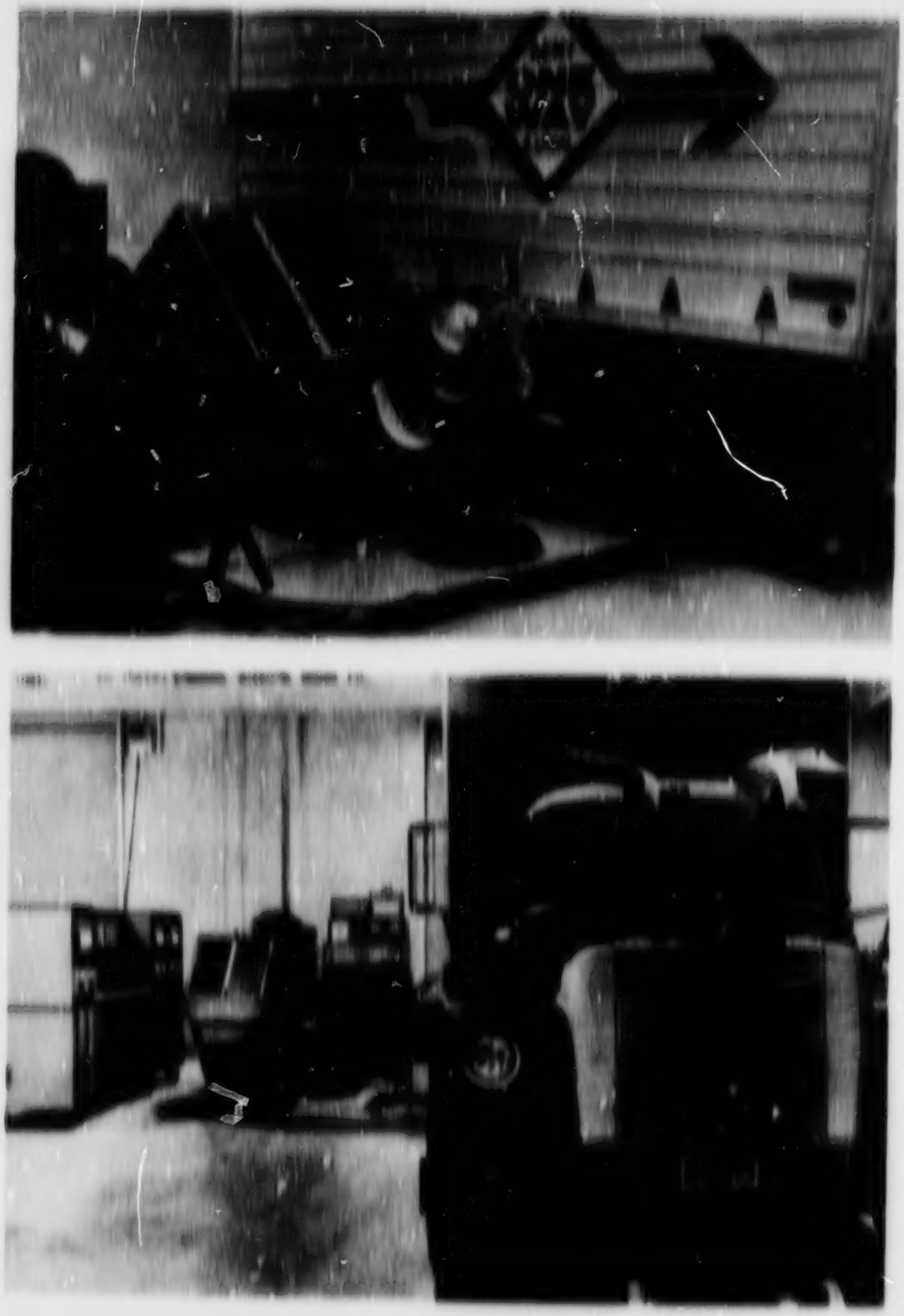
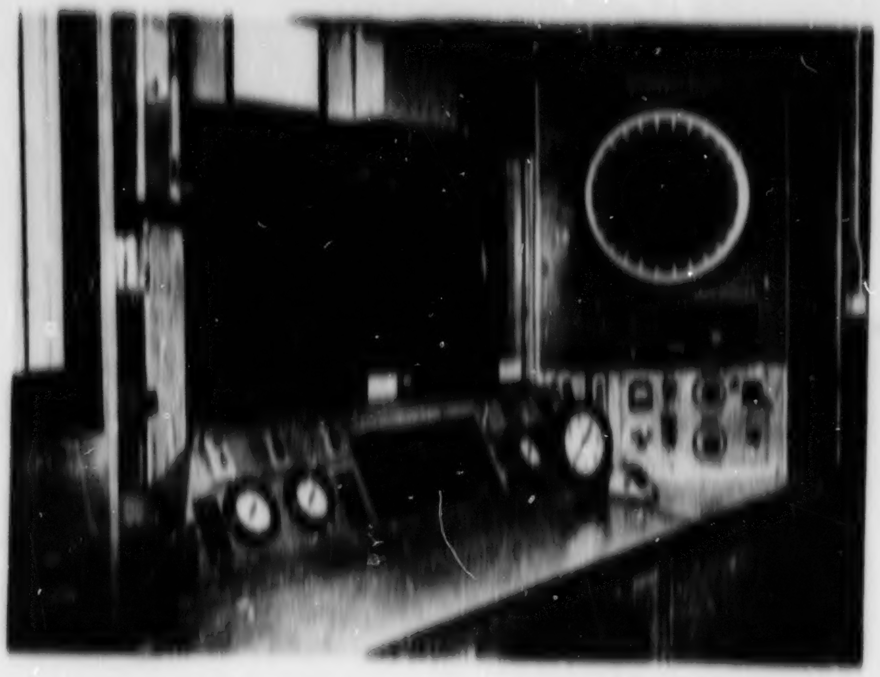
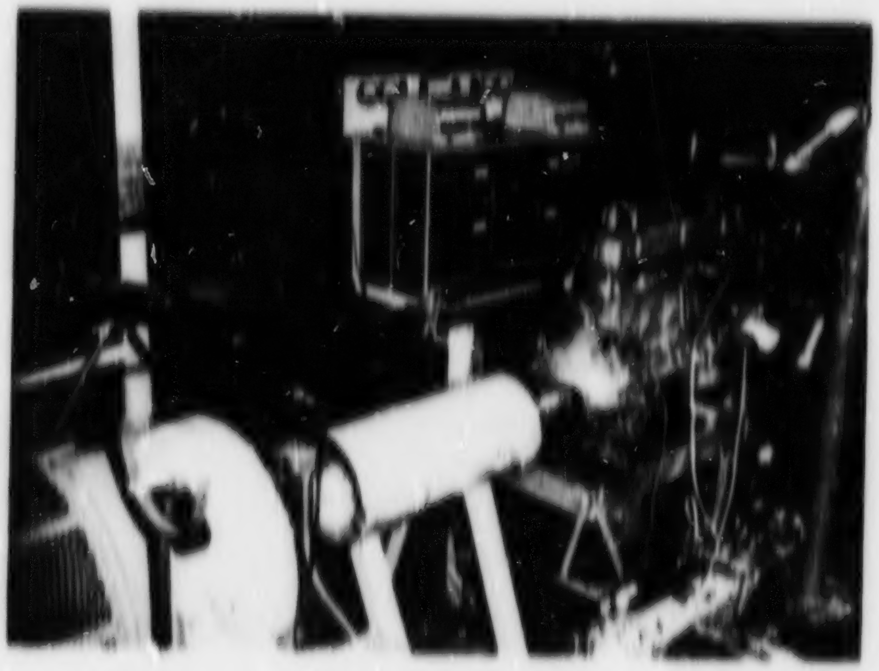


FIGURE 1. SwRI EMISSIONS RESEARCH LABORATORY HIGH BAY FOR GASOLINE POWERED TRUCK TESTING



Control Console, Test Cell No. 3



Typical Engine Installation, Test Cell No. 3

FIGURE 2. TEST CELL NO. 3 U.S. ARMY FUELS AND LUBRICANTS LABORATORY, SwRI

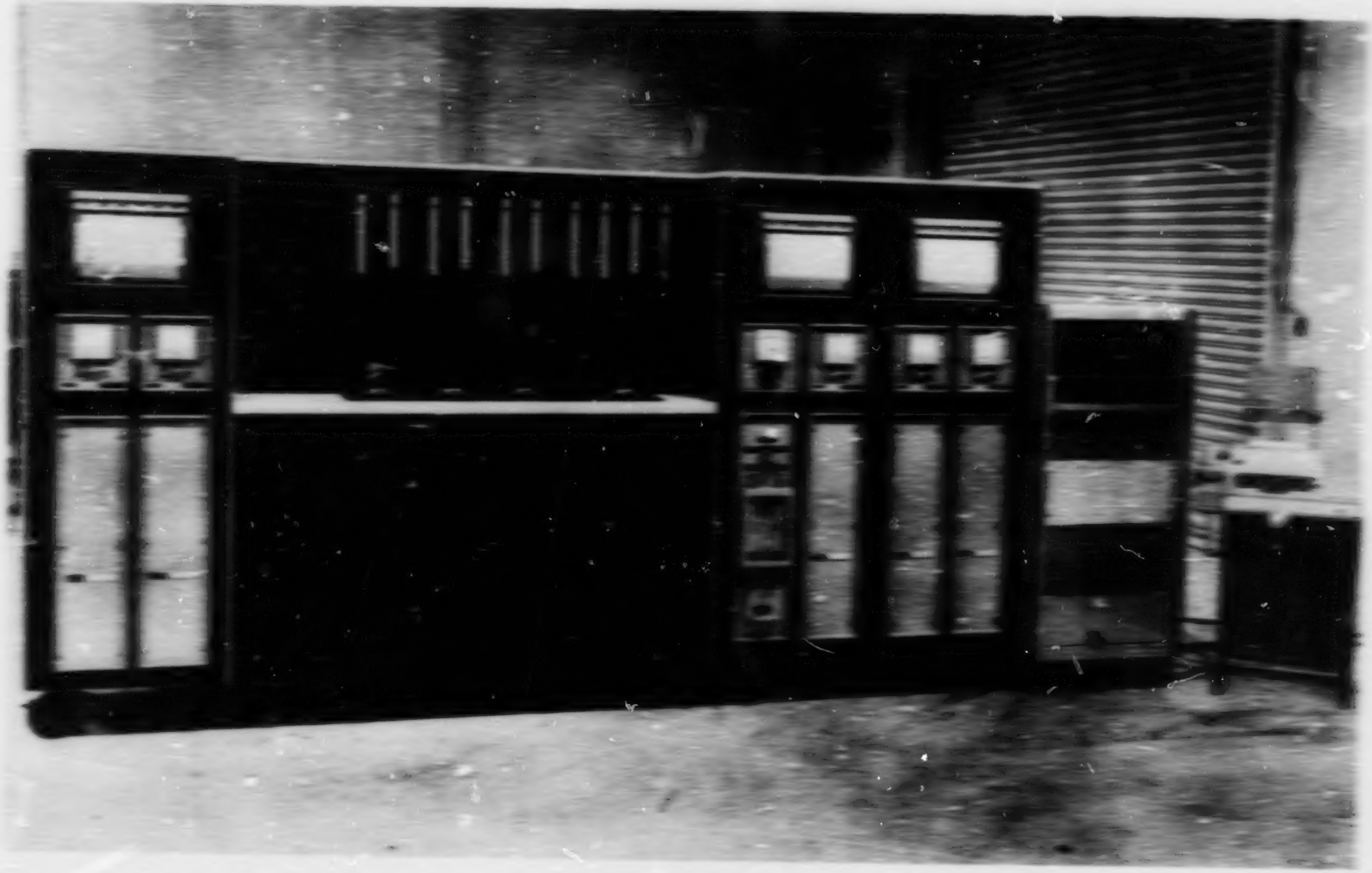


FIGURE 1. CONTINUOUS NDIR SAMPLING/ANALYSIS/
COMPUTER SYSTEM USED FOR NINE-MODE FTP TESTS

(1) Low-Range HC - 1000 ppm hexane
(2) High-Range HC - 10,000 ppm hexane
(3) CO - 11 percent
(4) CO_2 - 16 percent
(5) NO - 4000 ppm

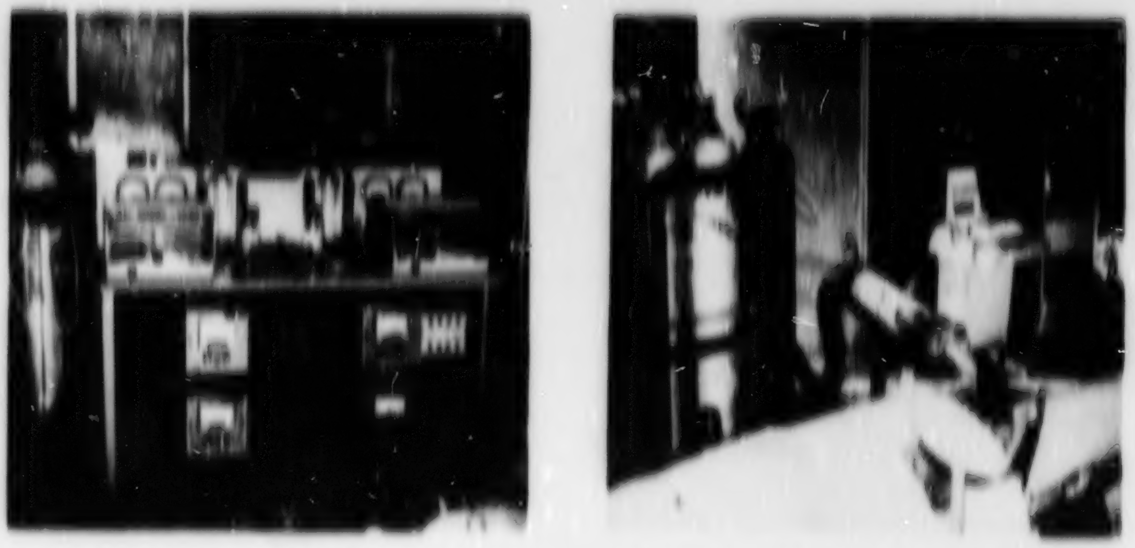
Although nitric oxide is not included in the current Federal regulations for gasoline HDVs, it is anticipated that it will be included in future regulations, and so is important from a research standpoint.

The NDIR cart was subjected to a rigorous calibration according to exacting EPA requirements. Both static and dynamic gas simulator tests were run initially on this and a similar hook-up cart by Mr. Matt Macocha of EPA during the period of September-November, 1971. Recheck of calibrations and instrument response was accomplished periodically during the course of this project by EPA. More frequent calibrations of all NDIR instruments were made to assure optimum accuracy. One of the EPA checks was to name an unknown to ±1 percent, a difficult requirement since the basic detector is only specified to ±1 percent by the manufacturer. Suffice to say that no tests were made until initial calibrations were satisfactorily completed and an EPA acceptance of time response obtained.

The automatic data acquisition system was designed and assembled by SwRI. The system's main components are a Data General Super Nova computer with an 8090 word central processory, a Computer Products Series RTP7410 analog to digital converter and multiplexer, and a model ASR33 teletype. The computer programing was also done by Institute personnel. The data acquisition system accepts analog (voltage) signals directly from the NDIR analyzers, digitalizes these signals and converts them to the proper units of concentration for processing to obtain the composite values of HC, CO, and NO required by the FTP.

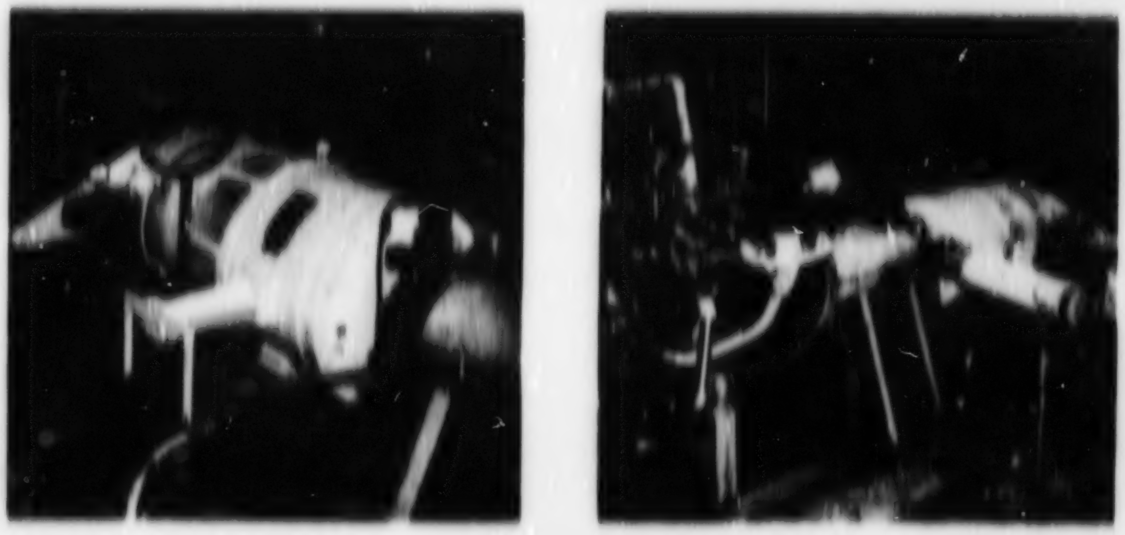
The output of each analyzer is also fed to strip-chart recorders. The concentrations of each contaminant can be obtained from the continuous traces by hand as specified in the nine-mode FTP. The average concentrations are then transferred to computer cards for futher processing to obtain composite values for HC, CO, and NO. This method was used for part of the first inspection round and as a back-up to the real time data acquisition system normally used for subsequent inspection rounds. The accuracy and repeatability of the automatic data acquisition system has been shown to be equal or better than manual chart reading and computer reduction of data.

For the stationary-to-chassis dynamometer correlation tests, a similar gas sampling and analysis train was used with the same automatic data acquisition system. This sampling and analysis system, which can be seen in Figure 4, uses Beckman NDIR gas analyzers in a sampling system built by Scott Laboratories. This sampling train also meets the Federal requirements for heavy-duty exhaust sampling.



Beckman/Scott NDIR Sampling and Analysis System

Automatic Data Acquisition System



Electric Eaton Dynamometer

Typical Engine Installation

FIGURE 4. INSTRUMENTATION AND ENGINE INSTALLATION TEST CELL NO. 3, ARMY FUEL AND LUBRICANTS LABORATORY

2. Chassis Dynamometer

The SwRI chassis dynamometer system used in this and previous projects is a modified Clayton CT-200 series dynamometer. Up to 200 hp. may be absorbed with this water brake-type of absorber. This system incorporates a 50 hp, three phase, AC electric motor that, when engaged, will maintain a constant rear wheel speed during power and closed throttle (CT) operation. The electric motor is coupled to the front roll of the chassis dynamometer with a positive drive belt. The vehicle engine speed can be changed by changing vehicle rear wheel speeds either by operating in a different transmission drive gear or changing motor drive pulleys. Figure 1 shows typical views of trucks being operated on this dynamometer. The top photograph is a side view of a truck mounted on the dynamometer rolls.

3. Stationary Engine Dynamometer

The engine dynamometer used for engine tests in the U.S. Army Fuel and Lubricants Research Laboratory is an all electric Eaton Dynamatic dynamometer. This dynamometer is capable of absorbing 300 hp. at engine speeds from 2100 to 5000 rpm with 50 hp. motoring capacity at speeds up to 3500 rpm. Figures 2 and 4 show the dynamometer and typical engine installation.

4. Miscellaneous Instrumentation

Other pertinent instrumentation used in the surveillance tests include a Curtin Company laboratory mercury barometer mounted in the high bay area, a Bendix "Psychron" Model 566 psychrometer for determining humidity, a General Radio Type 1531 "Strobtac" for measuring engine rpm, and a Sun Model 1120 Electronic Engine Tester for determining engine condition.

C. Vehicles - Engines Tested

1. Surveillance Fleet

This fleet of 145 (originally 152) 1970 and 1971 trucks was assembled with the aim of obtaining as many makes and models of trucks as possible, with groups of 5 to 10 trucks per model if at all feasible. While the truck population by make and model was considered, other factors such as type of operation and maintenance were also considered in the fleet make-up. Availability of a truck in the local area also affected the fleet composition. The resulting fleet, shown by manufacturer and displacement in Table 1, is a compromise of all these considerations. Figures 5, 6 and 7 show examples of the varied kinds and sizes of trucks that make up the surveillance fleet.

Appendix Table A-2 lists the entire 152 trucks, with sources, engine model, GVW, etc., shown for each truck. For purposes of analysis, this fleet has been divided into 23 categories of engine make and displacement. These categories are shown in Table A-3.

TABLE 1. BREAKDOWN OF SURVEILLANCE FLEET BY MAKE AND DISPLACEMENT

Chevrolet

4	250 CID 6; all 1970
2	292 CID 6; all 1970
11	307 CID V-8; all 1970
7	350 CID V-8; all 1971
2	366 CID V-8; all 1970
2	427 CID V-8; 1971
28	TOTAL

Dodge

8	225 CID 6; all 1970
15	318 CID V-8; all 1970
23	TOTAL

Ford

3	240 CID 6; all 1970
17	300 CID 6; all 1970
1	302 CID V-8; all 1970
4	330 CID V-8; all 1970
5	360 CID V-8; all 1970
3	361 CID V-8; all 1970
1	391 CID V-8; all 1971
34	TOTAL

GMC

5	292 CID 6; all 1970
2	350 CID V-8; all 1970
1	401 CID V-6; all 1970
8	TOTAL

IHC

13	304 CID V-8; twelve 1970; one 1971
8	345 CID V-8; six 1970; two 1971
23	392 CID V-8; six 1970; seventeen 1971
7	478 CID V-8; four 1970; three 1971
51	TOTAL

White

5	400 CID; all 1970

Grand Total	152
Number of Six Cylinder Engines	34
Number of V-8 Cylinder Engines	118
Number of 1970 Vehicles - Engines	118
Number of 1971 Vehicles	34

Unit 55 - 1970 IHC 304 CID V-8

Unit 57 - 1970 IHC 304 CID V-8

Unit 60 - 1970 Chevrolet 307 CID V-8

Unit 64 - 1970 Dodge 318 CID V-8

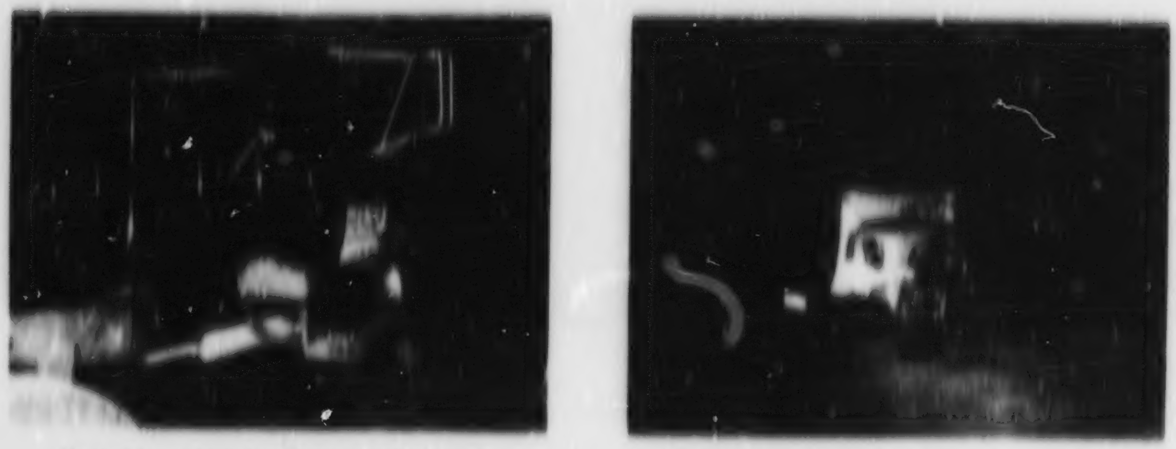
Unit 68 - 1970 Ford 361 CID V-8

Unit 72 - 1971 IHC 345 CID V-8

FIGURE 5. EXAMPLES OF SURVEILLANCE TRUCK

Unit 77 - 1970 Dodge 225 CID 6

Unit 81 - 1970 Ford 300 CID 6



Unit 83 - 1970 Ford 361 CID V-8

Unit 91 - 1970 IHC 345 CID V-8

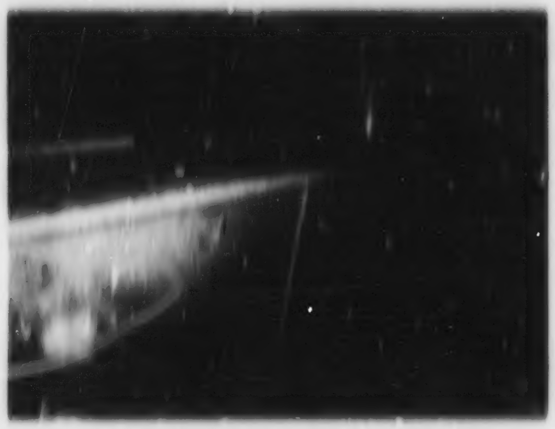
Unit 101 - 1970 Ford 330 CID V-8

Unit 105 - 1970 IHC 392 CID V-8

FIGURE 6, EXAMPLES OF SURVEILLANCE TRUCKS

Unit 106 - 1970 Ford 360 CID V-8

Unit 110 - 1970 Chevrolet 307 CID V-8



Unit 112 - 1970 Chevrolet 307 CID V-8

Unit 117 - 1970 GMC 350 CID V-8

Unit 123 - 1970 GMC 292 CID I6

FIGURE 7. EXAMPLES OF SURVEILLANCE TRUCKS

2. Stationary-to-Chassis Correlation Group

This group of 10 trucks/engines used to check the stationary-to-chassis dynamometer correlation were selected to represent as many different makes, displacements and gross vehicle weights as possible. Emission levels were not considered when choosing trucks for this or any other part of the contract. All were either 1970 or 71 trucks, except for correlation Truck 4, which was a 1969 Dodge. This truck while a 1969 truck was "emission control equipped" as Chrysler Corporation equipped all of its 1969 trucks to meet the 1969 California standards. The 1969 California standards were the same as the 1970 Federal standards. Because of the time required to remove the engine from the vehicle for testing on the stationary dynamometer, mostly rental trucks were used for this part of the project. Appendix Table A-1 describes the 10 trucks. Figure 8 shows some of the trucks and engines on their respective dynamometer.

D. Vehicle - Engine Preparation

1. Surveillance Fleet

No specific preparations to this group of trucks were made for the surveillance tests. A tag was placed in the engine compartment of each truck stating the following:

> "Engine on 12 month fleet test for Southwest Research Institute. Engine to be maintained normally in accord with usual fleet practice. Please report any difficulties requiring adjustments to carburation, ignition or internal engine maintenance to [here the name of supplier's maintenance supervisor is inserted]."

The fleet sources were also contacted personally to insure that they understood no changes in their current maintenance procedure were desired. At each test the exhaust system on each truck was inspected and repaired or tightened where required to provide a leak-tight exhaust system.

2. Stationary-to-Chassis Correlation Group

Other than to insure that the engines were tuned to factory specifications, no truck except the 1969 Dodge required any maintenance. The 1969 Dodge received new plugs, points, condenser, fuel filters, distributor and carburetor. The engine was then tuned to factory specifications. For operation on the stationary dynamometer, the engine and exhaust system was removed from the vehicle. The transmission and radiator were left with the truck.

Truck No. 3 Engine, 1969 Dodge 318 CID
V-8, on Stationary Dynamometer

Truck No. 5, 1971 Ford 330 CID V-8,
on Chassis Dynamometer

Truck No. 5 Engine, 1971 Ford 330 CID
V-8, on Stationary Dynamometer

Truck No. 7 Engine, 1970 IHC 345 CID
V-8, on Stationary Dynamometer

FIGURE 8. CORRELATION GROUP ENGINES AND TRUCKS
ON TEST DYNAMOMETERS

E. Fuel

The fuel used during all emissions tests, both chassis and stationary, met the requirements of the Federal Regulations(9). A typical fuel analysis of the fuel used is given in Table 2.

F. Test Procedure

1. Heavy-Duty Gasoline Nine-Mode Federal Test Procedure

The engine-operating schedule for both the surveillance tests and correlation tests was the nine-mode Federal Test Procedure(7). The correlation tests run on the stationary engine dynamometer adhered strictly to the FTP as published in the November 10, 1970, Federal Register. The chassis dynamometer tests were run using a chassis dynamometer version of the FTP contained in the proposed Federal Standard of January 4, 1968 as an alternate to the stationary method.(8) This chassis version was deleted when the regulations were adopted and published in the June 4, 1968, Federal Register(9).

Briefly, the nine-mode FTP consists of the schedule shown in Table 3, which is run four times for a total running time of 20 minutes. The weighting factors, listed in the last column of the table are used to calculate the concentration results. The complete Federal Test Procedure as published in the November 10, 1970, Federal Register is included in this report as Appendix C for convenient reference.

2. Surveillance Trucks

When a truck is brought in for a surveillance test, it is placed on the chassis dynamometer and the engine checked to determine the timing, idle speed and dwell. A tee is installed in an inlet vacuum line and connected to the driver's vacuum gage. At the first inspection the truck is then run at the various vacuum levels specified in the FTP and the engine speed checked using a stroboscopic tachometer to insure that the speed is within ±100 rpm of the specified 2000 rpm with the motor pulleys used. The fuel line from the vehicle gas tank to the engine fuel pump is disconnected and a line installed from the test fuel tank. The engine is then allowed to soak for an hour prior to starting the test. The gas analyzers are checked using zero level gas and a known concentration gas. The exhaust gas sample probe is placed in the tailpipe. Just prior to starting the test, the barometric pressure and wet and dry bulb temperatures are recorded. The radiator cooling fan is started and the engine started and warmed up for five minutes as prescribed in the Federal Regulations. The nine-mode FTP is then begun. At the completion of the FTP, the sampling system is checked for hydrocarbon "hang up" and the instrument calibration rechecked.

If the engine is not within ± 3° spark timing or ± 100 rpm idle speed of the manufacturer's specifications, these items are adjusted to the

TABLE 2. INSPECTION OF LEADED PREMIUM MOTOR GASOLINE USED FOR ALL TESTS

Gravity, deg API (D287)	59.3
Distillation Range (D 86)	
Initial Boiling Point, °F	88
5% Point, °F	116
10% Point, °F	127
20% Point, °F	150
30% Point, °F	175
40% Point, °F	200
50% Point, °F	220
60% Point, °F	235
70% Point, °F	254
80% Point, °F	276
90% Point, °F	305
95% Point, °F	327
End Point	340
% Recovery	98.0
% Residue	1.0
% Loss	1.0
Octane No., Research (D1656)	103.4
Total Sulfur, % wt (D1266)	0.004
Reid Vapor Pressure, psi (D323)	9.1
Hydrocarbon Composition (D1319)	
Olefins, %	0.4
Aromatics, %	27.3
Saturates, %	72.3
Lead (Organic) g/gal (D526)	3.171
Phosphorus, Theory	0.0
Oxidation Stability (D525)	600+
Existent Gum, mg (D381)	0.6

TABLE 3. CURRENT FEDERAL NINE-MODE CONSTANT SPEED PROCEDURE FOR HEAVY-DUTY GASOLINE TRUCKS

Sequence Number	Manifold Vacuum	Time in Mode, sec	Cumulative Time, sec	Weighting Factors
1	Idle	70	70 (1:10)	0.036
2	16 in. Hg	23	93 (1:33)	0.089
3	10 in. Hg	44	137 (2:17)	0.257
4	16 in. Hg	23	160 (2:40)	0.089
5	19 in. Hg	17	177 (2:57)	0.047
6	16 in. Hg	23	200 (3:20)	0.089
7	3 in. Hg	34	234 (3:54)	0.283
8	16 in. Hg	23	257 (4:17)	0.089
9	Closed Throttle	43	300 (5:00)	0.021

Engine Speed 2000 ± 100 rpm.

An initial 5-min idle, two warmup cycles and two hot cycles constitute a complete dynamometer run.

specifications, the engine is allowed to cool for one hour and a second FTP run. The engine is adjusted back to its as received condition before returning the truck to service. The results from each nine-mode test are computed in accordance with paragraph 85.109 of the applicable Federal Regulations (see Appendix C). In addition, the composite value of NO is corrected for humidity using the correction factor developed by the Ethyl Corporation.(11)

3. Correlation Group

Each of the 10 engines tested during this part of the procedure was first checked in the vehicle to insure that it was within the manufacturers' specifications for idle speed, timing, dwell, carburetor adjustments, and compression. The spark plugs were also checked with an oscilloscope to insure that each one was firing properly. The truck was then tested on the chassis dynamometer using the same procedure as the surveillance trucks. Several chassis FTP tests were run, with a one hour soak period between each test to verify the emission levels obtained.

The engine, without the radiator and transmission, was removed from the vehicle and installed on the stationary engine dynamometer. The same vacuum gage and exhaust gas analyzers that were used with the chassis tests were moved to the test cell for use during the stationary tests.

The engine was mounted on the test stand directly coupled to the dynamometer and using the test stand water-to-water heat exchanger in place of the vehicle radiator. The vehicle exhaust system was connected to engine in so far as possible in the same configuration as on the truck. A mechanical-pneumatic throttle linkage was installed on the engine. The automatic data acquisition system was connected to the gas analyzers and several runs of the FTP were made to insure valid results.

The results of each of the nine-mode tests were calculated as specified in the Federal Regulations. The chassis and stationary runs were then averaged separately and the two averages compared.

IV. TEST RESULTS

A. Results of Correlation Tests

The results of the correlation tests are presented first since an understanding of these tests and their results is necessary for proper interpretation of the emission levels obtained from the surveillance tests. Table 4 is a summary of the average FTP emission levels obtained from the 10 correlation trucks/engines tested showing both chassis and stationary dynamometer results and the percentage difference between the two types of tests. As can be seen from the table, there is no one factor that will correlate the stationary and chassis tests for any of the emissions. However, with exception of the CO results from three trucks and the HC results from one of these trucks, the chassis results fall within ±25% of the stationary results. The worst agreement is shown by the CO emissions, with the largest difference for CO being 42% on Truck 4. More than half of the tests showed agreement within ±15%. A description of the trucks tested is given in Appendix Table A-1, and the individual test results for each truck are contained in Appendix B.

The exact reasons for the differences between chassis and stationary dynamometer tests are not known. A mode-by-mode comparison of the tests for each truck shows that much of the difference can be attributed to the idle, 3-inch vacuum level, and closed throttle modes. Idle and closed throttle conditions are known to be the least repeatable from test to test and this undoubtedly plays some part in the differences seen between chassis and stationary dynamometer tests. The major difference between the two test methods is in the engine operating environment. For the stationary dynamometer tests, the engine is in a large ventilated room with a much different radiant heat loss characteristic than when installed in the engine compartment of a vehicle. Convective heat losses are also different since in the vehicle the engine fan and floor fan in front of the radiator provide cooling air over the engine, while there is only natural circulation around the engine on the test stand. Even though the chassis engine mounts were used when the engine was on the stationary dynamometer, the engine vibration characteristics will be different than when the engine is mounted in the vehicle. These vibration differences may cause differences in carburetor operation. These ideas are offered as possible explanations. Further investigation of the correlation problem may be desirable if certification standards continue to be based on stationary engine dynamometer tests.

Since the stationary engine dynamometer tests were run in strict accordance with Federal Regulations, they can be directly compared to the Federal standards. Figure 9 is a histogram showing the levels of HC, CO, and corrected NO for these engines. Also shown are the Federal standards for each emission type. Since only one engine, selected by chance, of each engine model represented was tested, no conclusions can be drawn about a particular engine model from these tests.

TABLE 4. SUMMARY OF CORRELATION TRUCK RESULTS
9-MODE HEAVY DUTY GASOLINE FEDERAL CYCLE
STATIONARY TO CHASSIS DYNAMOMETER COMPARISON

	HC - PPM - HEX.			CO, %			NO - PPM					
							Observed			Corrected		
Truck	Average Station.	Average Chassis	% Diff.*	Average Station.	Average Chassis	% Diff.*	Average Station.	Average Chassis	% Diff.*	Average Station.	Average Chassis	% Diff.*
1	161	182	13.0	1.40	1.07	-23.6	2076	1747	-15.9	2296	1735	-24.5
2	143	172	20.3	0.46	0.65	36.0	1494	1703	14.0	1600	1705	6.6
3	297	293	-1.3	4.43	3.31	-25.3	1577	1648	4.5	1567	1579	0.8
4	163	207	27.0	1.70	2.41	41.8	1624	1705	5.0	1475	1611	9.2
5	188	216	15.0	1.18	1.04	-11.8	1326	1436	8.4	1130	1318	16.6
6	129	130	0.8	1.78	1.98	11.2	926	869	-6.1	811	754	-7.0
7	257	208	-19.1	1.61	2.07	28.6	2996	2341	-21.9	2245	2207	-1.7
8	214	227	6.1	1.57	1.40	-11.1	1611	1678	4.2	1685	1395	-17.2
9	186	162	-12.9	1.01	0.91	-9.9	3506	3484	-0.6	2833	3099	9.4
10	204	245	20.1	1.36	1.46	7.3	1586	1479	-6.7	1253	1252	-0.1
	194	204	6.9	1.66	1.63	3.8	1858	1810	-1.5	1690	1666	4.1

$$\text{*Percent difference} = \frac{(\text{Chassis} - \text{Stationary})}{\text{Stationary}} \times 100$$

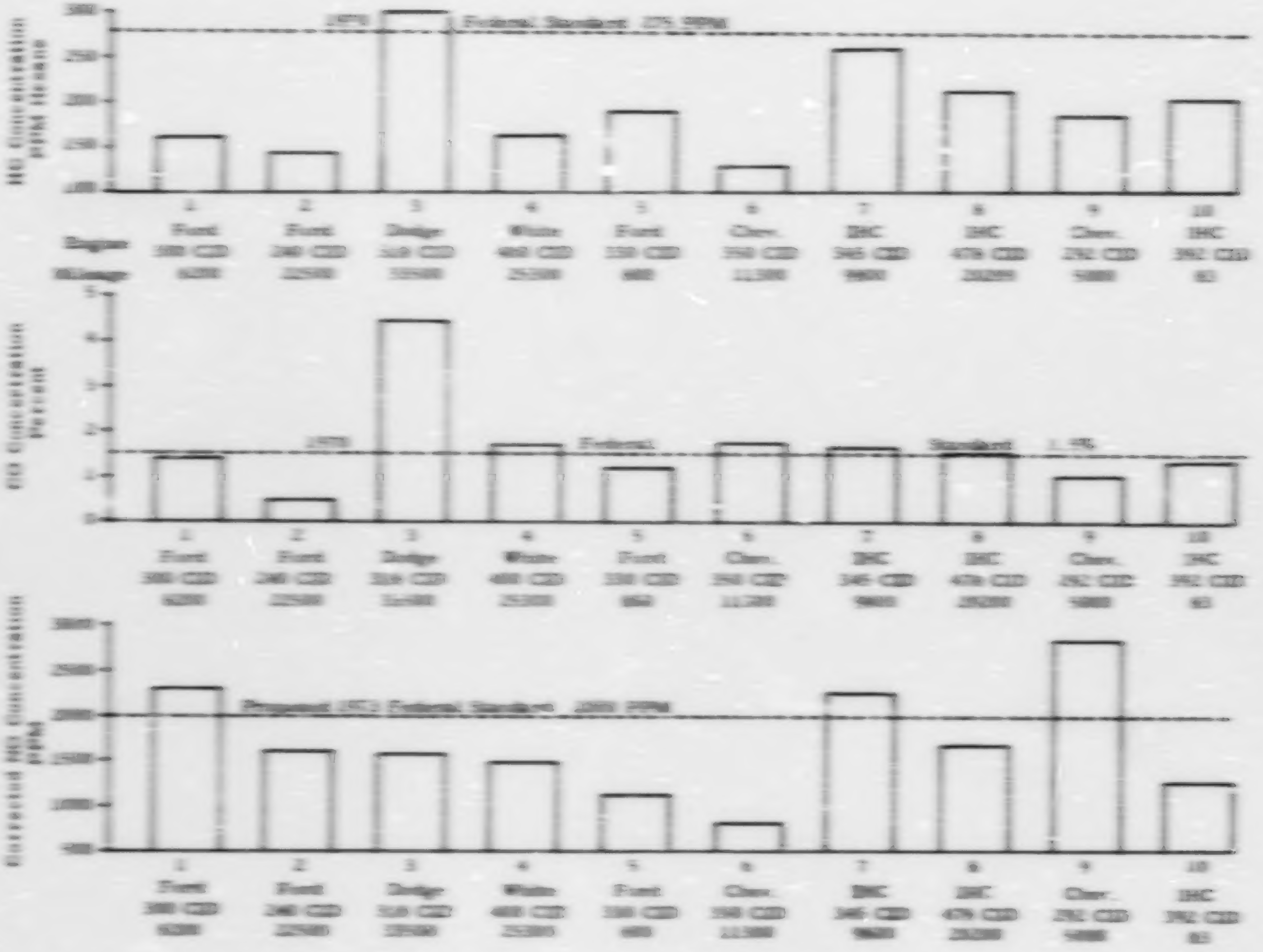


FIGURE 9. AVERAGE EXHAUST EMISSIONS FROM STATIONARY ENGINE DYNAMOMETER TESTS OF CORRELATION GROUP TRUCKS

B. Analysis of Surveillance Results

1. Results by Inspection Round

The results of the surveillance inspection tests for each truck are tabulated by test round in Appendix D as Tables D-1, D-2, D-3, and D-4 for rounds 1, 2, 3, and 4 respectively. To provide a means of comparing the emission levels from one round to the next, the test results from the first four tests have been plotted for each truck. These plots are contained in Appendix E. The wide range of both emission levels and changes in levels from test to test, shown on these plots, emphasizes the individuality of each truck and indicates the difficulty in arriving at any general conclusion. Obviously a large number of variables affect the test results. It is far beyond the scope of this contract to investigate and define all of these variables. Nevertheless, an attempt has been made to define some of the major variables and arrive at some general conclusions. It should not be surprising, however, that these will be individual trucks whose test results run counter to these general conclusions because of the effect of some parameter not considered.

The results from each inspection round were analysed independently to obtain average, maximum, and minimum values for each contaminant and to determine what factors contributed to the emission level differences within a given round.

Table 5 shows the average emission levels and the maximum and minimum levels for HC, CO, and corrected NO for the four inspection rounds completed to date. As can be seen from the table, the average emission levels have changed little over the first twelve months of operation. The changes between the first and fourth inspection rounds are 14.2%, 11.2%, 4.7%, and 0.1% for HC, CO, observed NO, and corrected NO respectively.

The arithmetical average of HC level for all rounds is below the 1970 Federal standard of 275 ppm; for CO the arithmetical mean for each round is above the 1970 Federal standard of 1.5%; the corrected NO average for each round is below the 1973 proposed Federal standard of 2000 ppm.(10) The Federal standards are used here as a convenient reference, and no conclusion should be drawn from comparison with Federal standards without regard to the chassis to stationary test differences explained previously and the truck model differences between the total population and the test fleet.

While the range of values for a contaminant in each round is quite large, an examination of the data indicates that it has a fairly normal distribution for all emissions. Figures 10, 11, 12, and 13 show the frequency distribution for each of the contaminants for rounds 1, 2, 3, and 4 respectively. While some skewness is evident, it is felt that it is not sufficient to affect the conclusions drawn from statistical methods based on a normal distribution.

TABLE 5. AVERAGE FLEET EMISSION LEVELS

		HC ppm n hex.	CO %	NO, ppm Obs.	NO, ppm Cor.
1.	First Round, Zero Months Operation (152 trucks)				
	Average	239	1.61	1782	1701
	Maximum Value	615	5.51	3985	3957
	Minimum Value	63	0.26	423	378
	Standard Deviation	66	0.81	646	614
2.	Second Round, 4 Months Operation (148 trucks)				
	Average	264	1.73	1880	1873
	Maximum Value	420	6.56	3488	3314
	Minimum Value	139	0.31	434	429
	Standard Deviation	52	0.88	584	563
3.	Third Round, 8 Months Operation (146 trucks)				
	Average	261	1.89	1940	1911
	Maximum Value	1838	11.92	3811	3879
	Minimum Value	95	0.19	272	266
	Standard Deviation	149	1.19	588	598
4.	Fourth Round, 12 Months Operation (145 trucks)				
	Average	273	1.79	1866	1703
	Maximum Value	2093	4.90	4008	3696
	Minimum Value	120	.15	439	378
	Standard Deviation	219	.85	677	594
	Differences Between First and Fourth Round	14.2%	11.2%	4.7%	0.1%

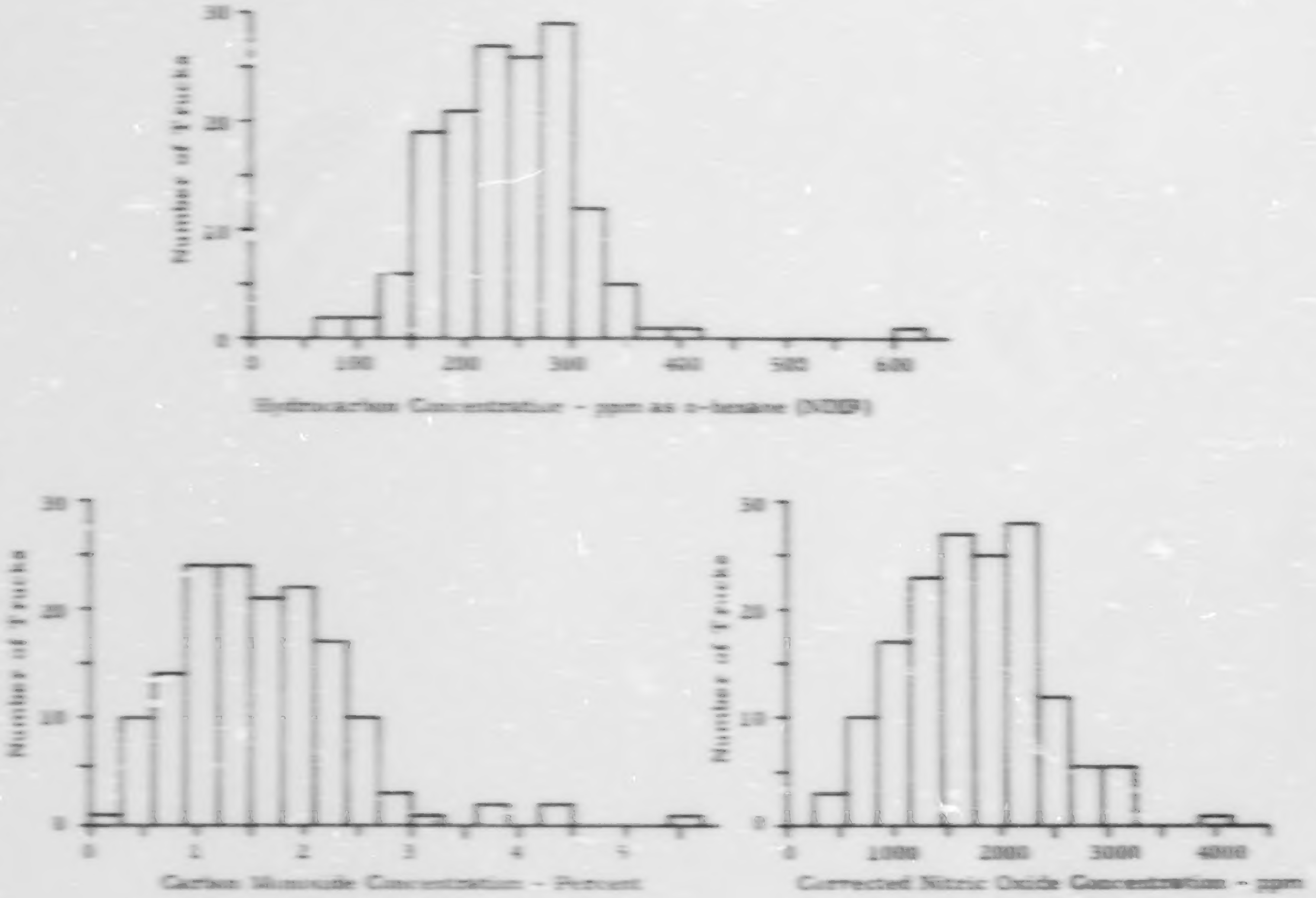


FIGURE 16. FREQUENCY DISTRIBUTION OF EXHAUST EMISSION LEVELS FOR FIRST ROUND INSPECTIONS (152 TRUCKS)

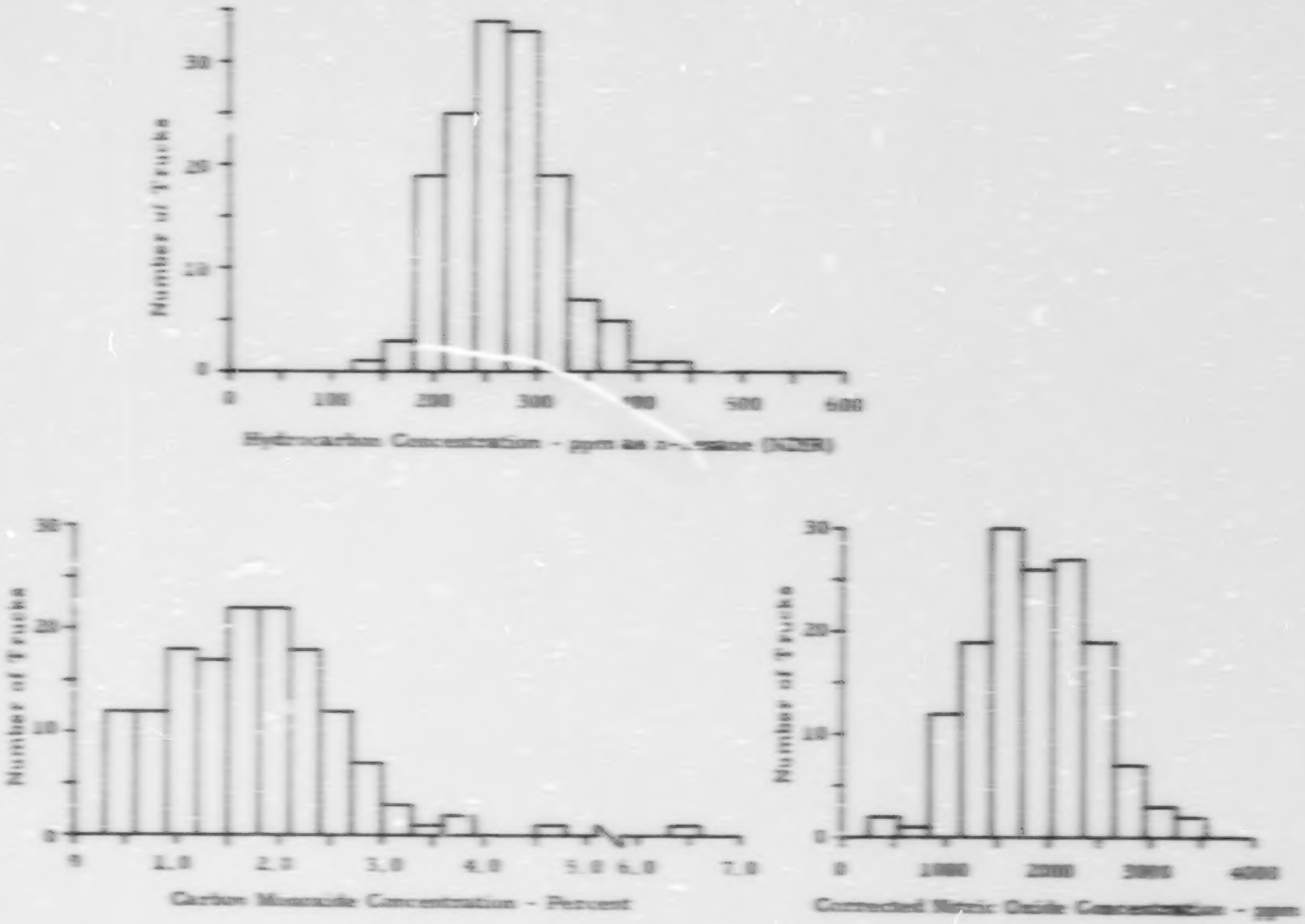


FIGURE 11. FREQUENCY DISTRIBUTION OF EXHAUST EMISSION LEVELS FOR SECOND ROUND INSPECTIONS (140 TRUCKS)

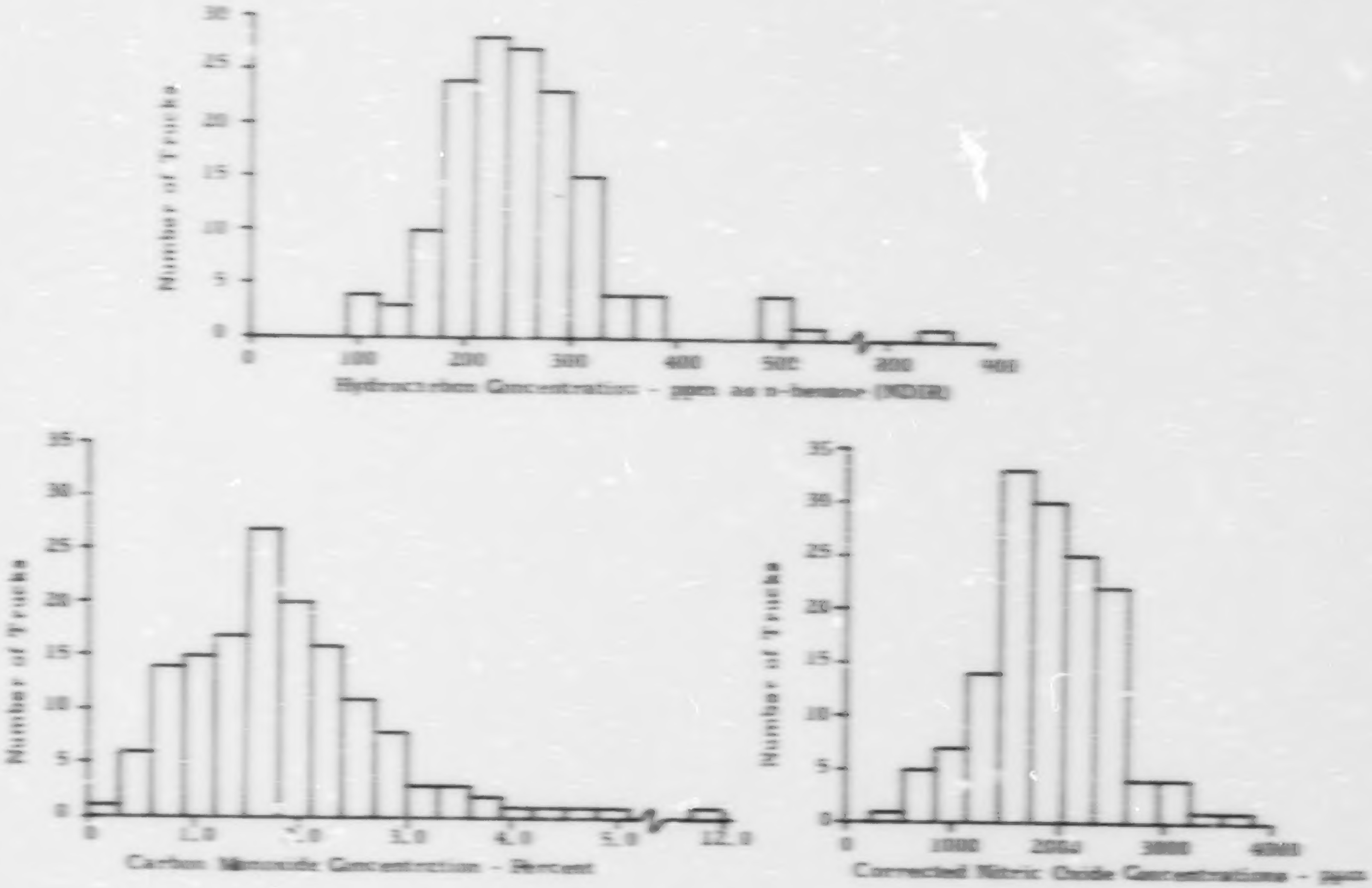


FIGURE 12. FREQUENCY DISTRIBUTION OF EXHAUST EMISSION LEVELS FOR THIRD ROUND INSPECTIONS (148 TRUCKS)

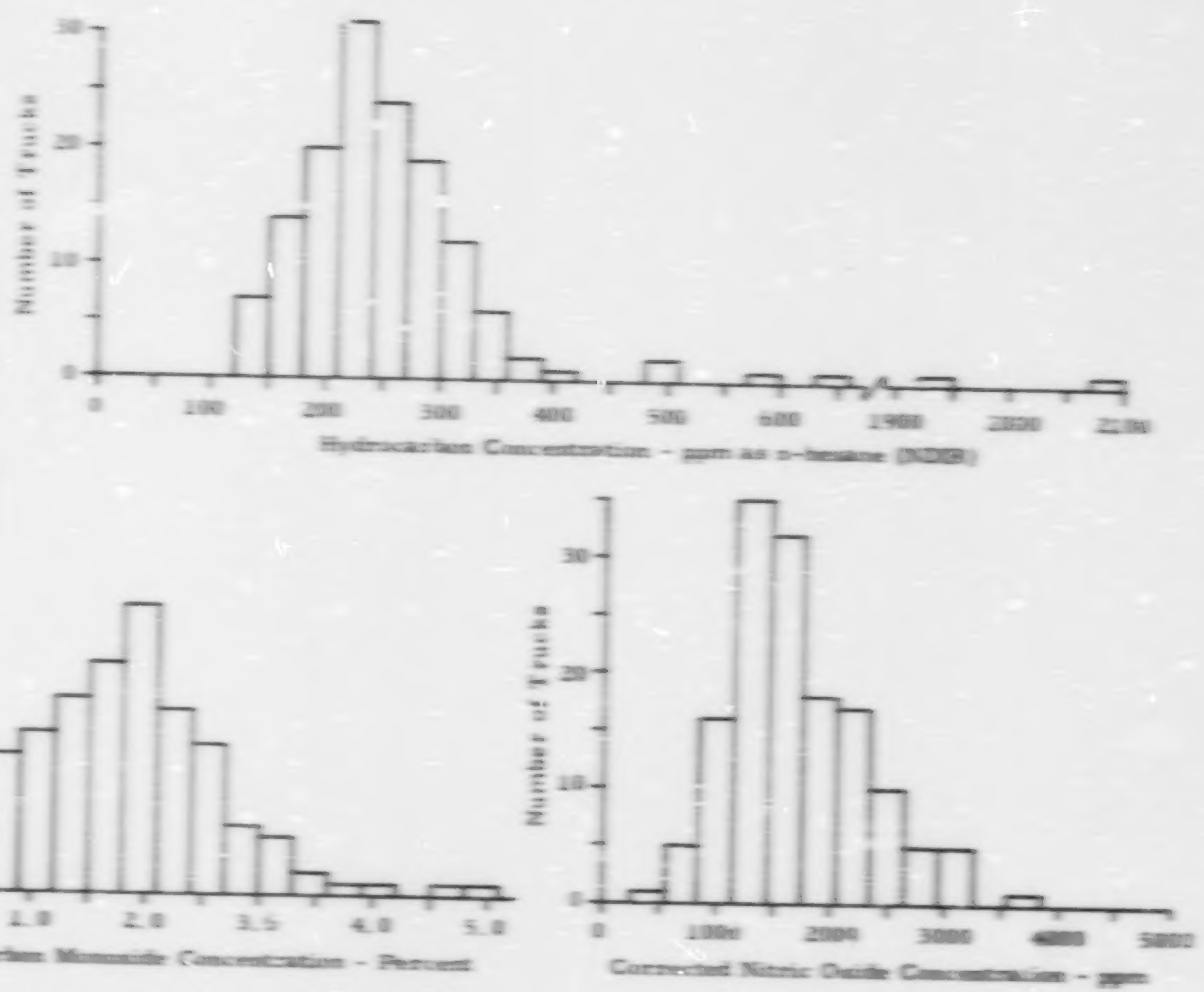


FIGURE 13. FREQUENCY DISTRIBUTION OF EXHAUST EMISSION LEVELS FOR FOURTH ROUND INSPECTIONS (146 TRUCKS)

The cumulative distribution for each emission type is shown in Figures 14, 15, 16, and 17 for rounds 1 to 4 respectively. As can be seen from these figures, the percentage of vehicles tested which had HC emissions equal to or below the Federal standard was 72, 60, 58, and 70 percent for rounds 1, 2, 3, and 4; for CO, the percentage of vehicles at or below the Federal standard was 47, 40, 36, and 37 percent for rounds 1, 2, 3, and 4; for NO, the percentage at or below the 1973 proposed standards was 66, 53, 58, and 70 for rounds 1, 2, 3, and 4 respectively. As explained previously, the surveillance test results cannot be compared to Federal standards on an engine by engine basis; however, it is felt that the correlation between chassis and stationary dynamometer tests is close enough that the Federal standards may be used as a frame of reference for the fleet as a whole. Thus, where the majority of the fleet falls within the Federal standards it is probable that most of the engines in the fleet would meet the Federal standards if tested on a stationary engine dynamometer. Conversely, where most of the fleet was above the Federal standards, it is probable that most of the engines would be above the Federal standards if tested on a chassis dynamometer.

To determine what factors were significant in explaining the variation of emission levels within each inspection round, analysis of variance techniques were used to analyze each round. A linear regression analysis was performed on the first round data when 81 of the 152 trucks had completed testing. The analysis was done on HC, CO, and observed NO with engine make, number of cylinders, and gross weight each as the independent variable. The results indicated that for each emission, there was a significant difference due to make. For HC and CO it was the only significant factor. For observed NO, however, the number of cylinders seemed to be more significant than make. The V-8 engines in general seemed to have lower NO emissions than 6 cylinder engines. Since V-8 engines generally have larger displacements than 6 cylinder engines, this may also indicate that displacement has an affect on NO emissions.

When the first test round was completed, examination of the data indicated that engine manufacturer and number of cylinders alone would not explain the differences in emission levels. It was, therefore, decided to analyze the data by engine model (manufacturer, displacement, and number of cylinders) using a one way analysis of variance. This was done for each of the emissions using 17 of the 23 engine model groups in the fleet. See Appendix Table A-3 for a description of each engine model group. The other six engine model groups had too few engines in the group for statistical analysis. The results of this analysis indicated a statistically significant difference at the .01 significance level. In other words, there is a one percent or less chance that the emission level differences seen between engine models are due to pure chance.

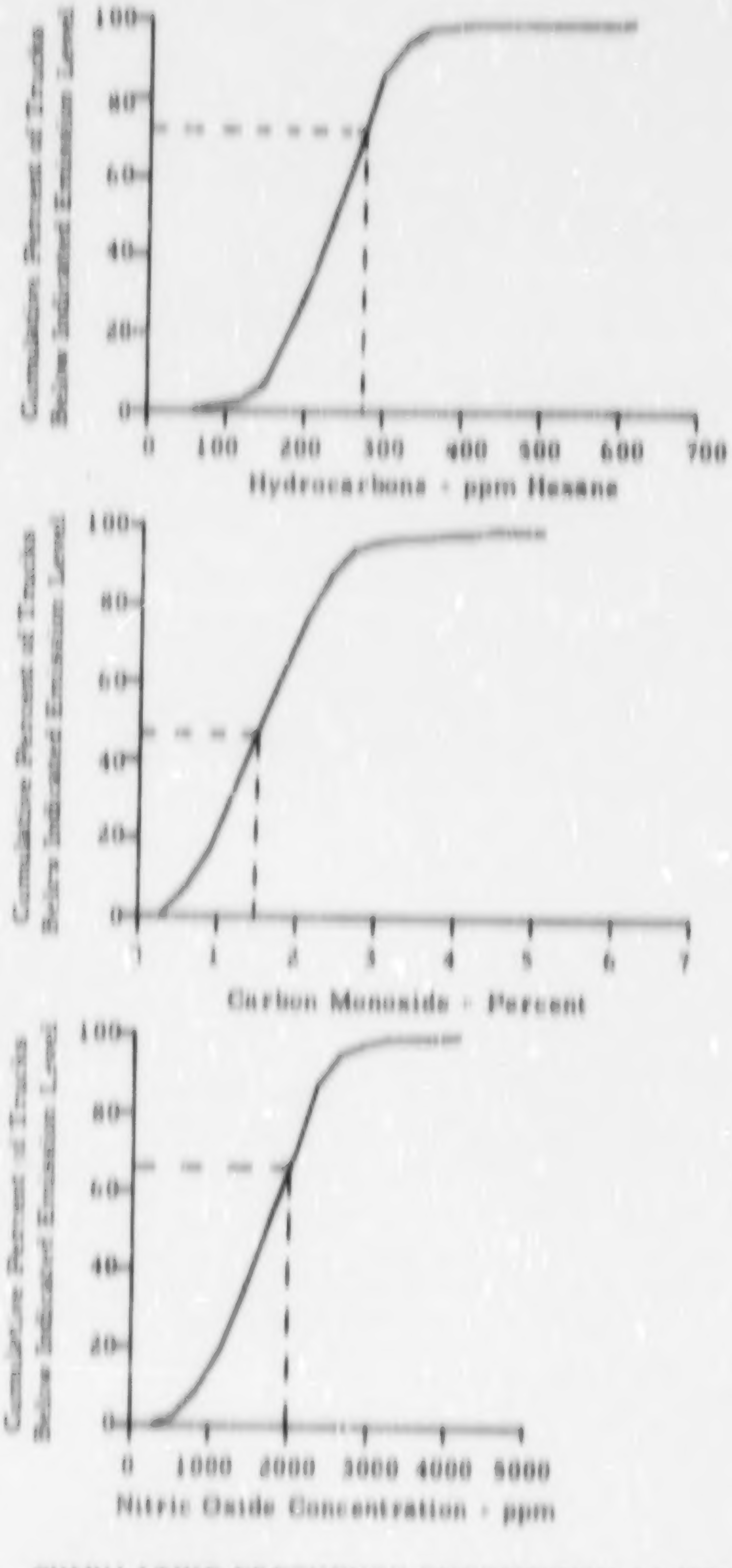


FIGURE 14. CUMULATIVE FREQUENCY DISTRIBUTION OF EXHAUST EMISSION LEVELS FOR FIRST ROUND INSPECTIONS (154 TRUCKS)

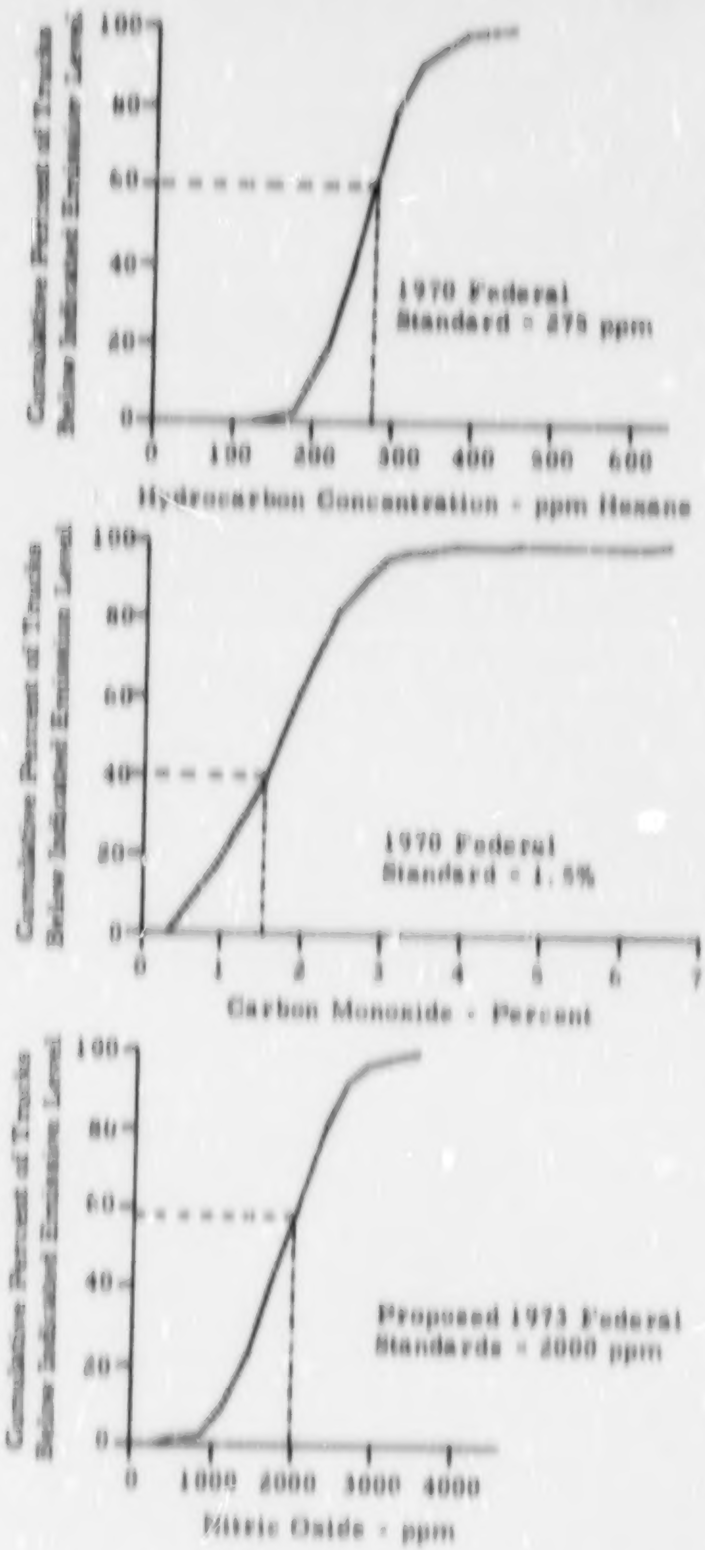


FIGURE 15. CUMULATIVE FREQUENCY DISTRIBUTION OF EXHAUST EMISSION LEVELS FOR SECOND ROUND INSPECTIONS (148 TRUCKS)

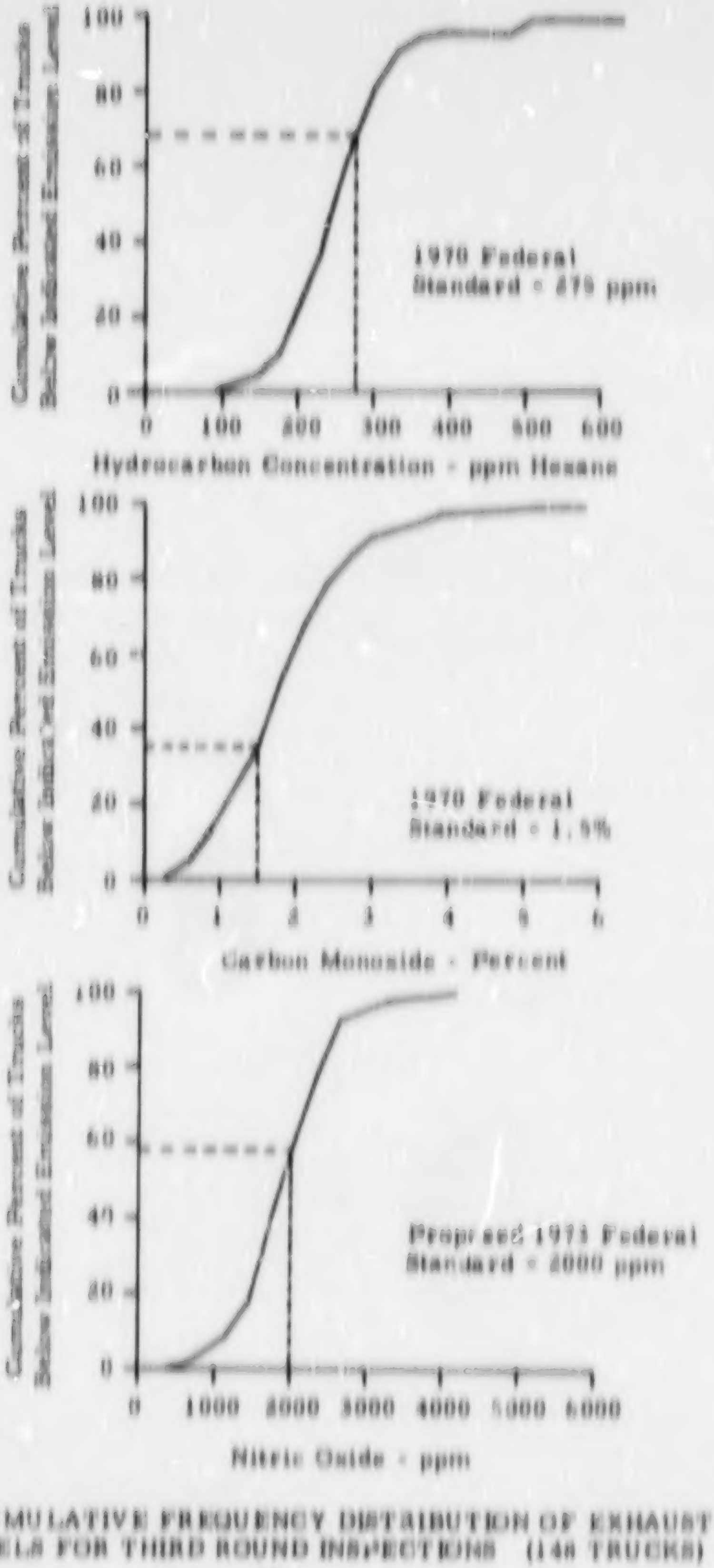


FIGURE 16. CUMULATIVE FREQUENCY DISTRIBUTION OF EXHAUST EMISSION LEVELS FOR THIRD ROUND INSPECTIONS (148 TRUCKS)

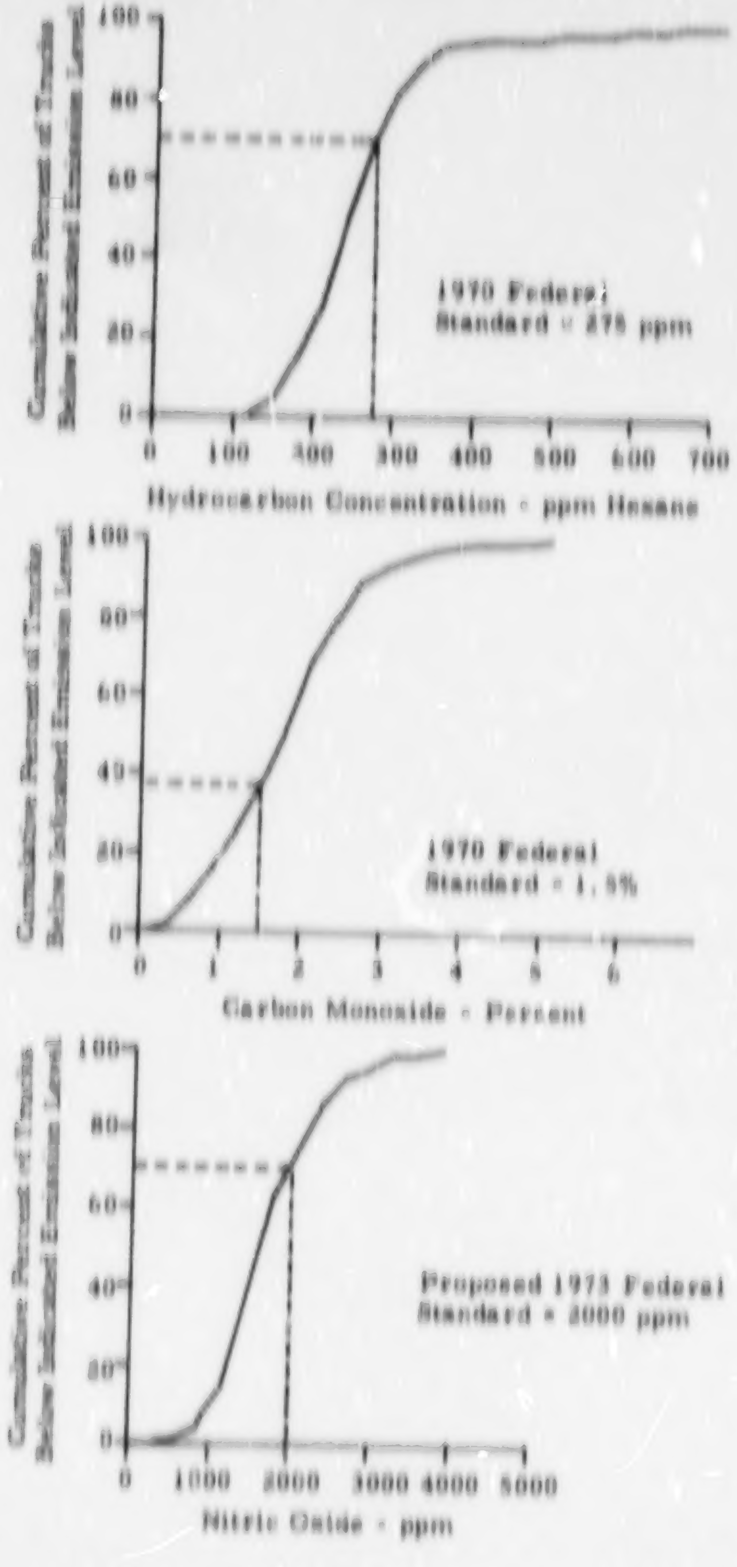


FIGURE 17. CUMULATIVE FREQUENCY DISTRIBUTION OF EXHAUST EMISSION LEVELS FOR FOURTH ROUND INSPECTIONS (145 TRUCKS)

To ascertain if other variables were significant factors in the emission level differences within the test round, a stepwise multiple linear regression analysis was performed. The following factors were considered.

Engine make and displacement (23)
Transmission (2)
Service Category (6)
Mileage group (4)
Gross weight group (3)
Mileage at start of test

The numbers in parentheses indicate how many categories were in each factor. See Appendix Table A-4 for a definition of each of these factors (other than engine group) and the trucks included in each group. Variables were defined as follows:

1-22 for engines
23 for transmission
24-28 for service group
29-31 for mileage group
32-33 for gross weight group
34 mileage at start of test
35 HC, CO, or observed NO

Variables 1-33 were assigned values of 0 or 1. For example, engine code 1 was represented by assigning zeroes to variables 1-22. Engine 2 was represented by assigning a value of 1 to variable 1 and zeroes to variables 2-22. A similar coding scheme was used for the other factors.

In general, results from the stepwise linear regression indicated again that engine make and displacement was the most significant factor in explaining variations in HC, CO, and NO. This was the only significant factor for HC. For CO, there appears to be a slight difference due to type of transmission. It should be noted, however, that of the 44 automatic transmissions, 22 were for the same engine model. Since only 7 of the 23 engine groups had any vehicles with automatic transmissions and these engine groups tended to be substantially all automatic transmissions or have only one automatic in the group, it is very hard to separate transmission from engine group. It would not be expected that transmission type would affect emissions since the nine-mode cycle is an engine exercise based solely on engine vacuum and RPM. It is felt, therefore, that the difference attributed to transmission is really due to engine group.

Initial mileage at the start of the project seemed to be a significant factor in observed NO. The correlation coefficient between initial mileage and observed NO is 0.401. However, initial mileage correlates well with many of the engine model groups, so that it is hard to separate initial mileage and engine group. Again, the best that can be said is that initial mileage may be significant in explaining observed NO emission differences within the round. The same multiple linear regression analysis was used on the second round results. The results for round 2 were the same as those for round 1, that is, the most significant factor in explaining emission level differences was engine model. As in round 1, CO differences showed some correlation with type of transmission and odometer mileage seeming to be a factor in observed NO differences.

Since the multiple linear regression analysis showed only those factors that had been previously used to be of significance, it was decided to use the one way analysis of variance technique on the subsequent rounds since it is easier to use and interpret and will yield just as useful results.

A one way analysis of variance was performed on the third round data using the factors that had been shown to be significant in the previous two inspection rounds. The analysis was done on each emission (HC, CO, observed NO and corrected NO) by engine model group (manufacturer, displacement and number of cylinders) again using 17 of the 23 engine model groups in the fleet.

For all emissions, engine group was a statistically significant variable at the .01 significance level. This agrees with the results from rounds 1 and 2 which also showed engine group as a statistically significant variable.

The analysis of variance was also run on both observed and corrected NO using number of engine cylinders as the independent variable. This analysis, too, indicated a statistical significance at the .01 significance level. Since number of cylinders is often an indication of displacement (6 cylinder engines normally having displacements below 300 cubic inches), it may be that displacement would correlate with NO levels. To check this, a regression analysis was performed on corrected NO with engine displacement as the independent variable. Since timing effects NO emissions (see section IV, B-2), it was decided to use the data taken with the engine at the specification values for timing and idle speed. The regression analysis failed to show a reasonable correlation between displacement and corrected NO levels for any of six different curve forms.

CO had previously appeared to be somewhat influenced by type of transmission. Although it was felt that this was due to the close correlation between engine model group and transmission type, the relationship was also checked for round 3 inspections using the one way analysis of variance. There was no correlation at the .01 significance level.

A similar analysis of variance was performed on the fourth round data with the same results. That is, for all emissions engine group was a statistically significant variable at the .01 significance level; both observed and corrected NO levels were found to correlate with number of engine cylinders. No correlation at .01 significance level was found between CO emission level and transmission type.

With the fact that engine model was significant in explaining the emission level variations established, the data was then examined by engine group. Figures 18, 19, and 20 show the average emission values for HC, CO, and corrected NO in the form of histograms for rounds 1, 2, 3, and 4. Also shown are the Federal emission standards for each emission. This graphical presentation provides a good overview for comparison of engine groups with each other and with the Federal standards.

Appendix Tables D-5 through D-20 list this information in tabular form together with the minimum value, maximum value and standard deviation for each group.

2. Effects of Timing and Idle Speed

As explained in Section III, the surveillance trucks were checked for timing and idle speed prior to each surveillance test. All vehicles tested in round 1 were intentionally run with timing and idle speed within manufacturers' specifications. The vehicles found to be out of timing and idle speed specifications during rounds 2, 3, and 4 were tested as received, then adjusted to manufacturers' specifications for timing and idle speed and retested. The trucks were restored to the as-received condition prior to being returned to service.

Appendix Tables D-21, D-22, and D-23 show the as-received and "in spec" emission levels for those vehicles found to be out of specification for rounds 2, 3, and 4 respectively. Of the 148 vehicles tested in round 2, 35 vehicles (about 23%) were found to be beyond the ±3° timing and/or ±100 rpm idle speed tolerances on the manufacturer's specifications; for round 3, 29 vehicles out of 148 (about 20%) were out of specifications limits; and for round 4, 24 vehicles of 145 (about 17%) were out of specification limits.

Appendix Tables D-24, D-25 and D-26 show the percent change in emissions for each truck as the result of adjusting timing and idle speed for rounds 2, 3, and 4.

The most common reason for retest was early timing. Timing was early on 22 of the 35 vehicle requiring test in round 2; 17 of 29 in round 3; and 13 of 24 in round 4. When the early timing was corrected, there was a substantial reduction in nitric oxide emission levels. A smaller, but fairly consistent reduction in hydrocarbons and carbon monoxide can also be seen. For those vehicles with late timing in almost every case emissions increased when adjusted to manufacturers specifications.

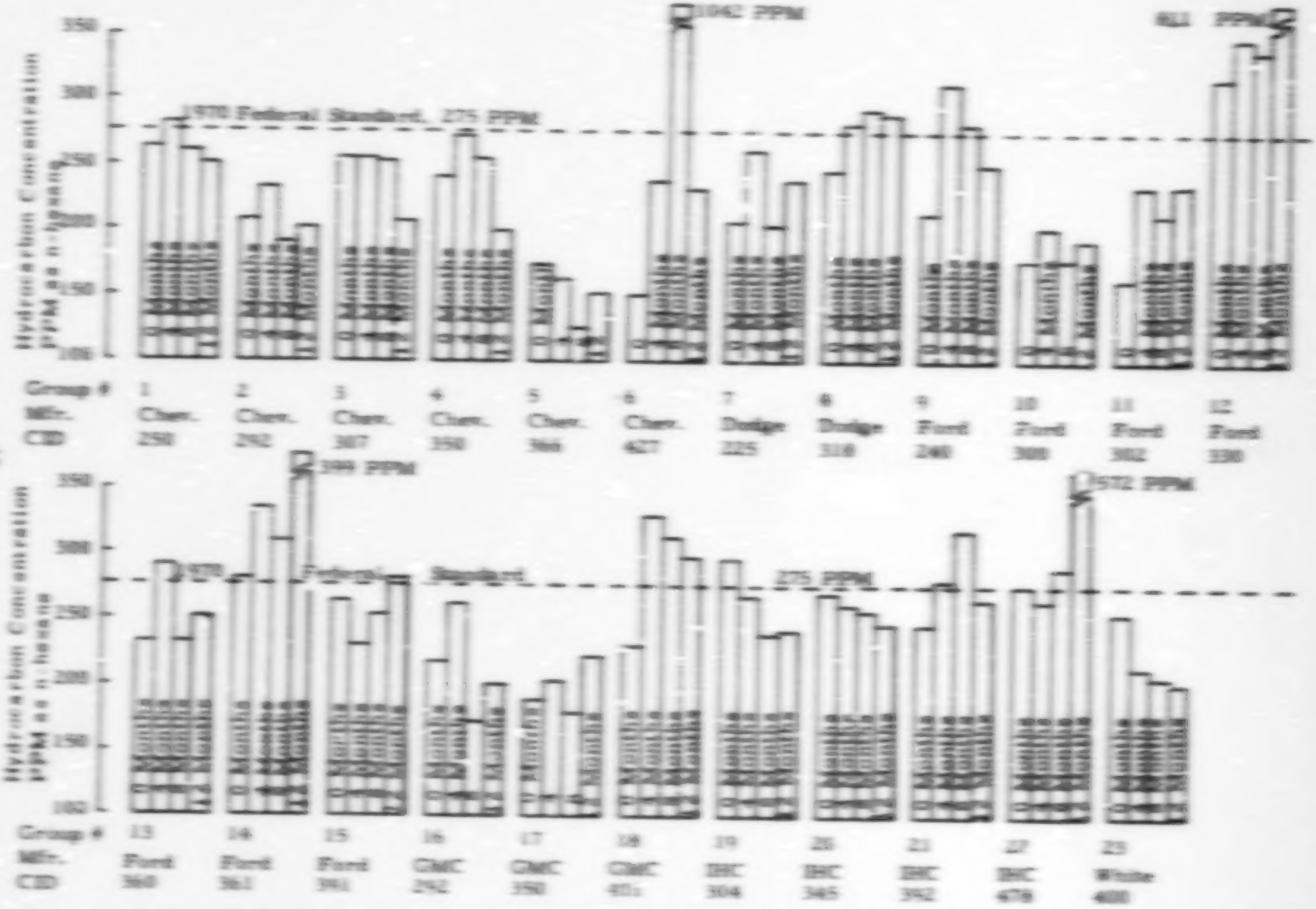


FIGURE 18. EXHAUST HYDROCARBON AVERAGE EMISSION LEVELS FOR THE 23 ENGINE MODEL GROUPS COMPRISING THE SURVEILLANCE FLEET. 0,4,8, AND 12 MONTH INSPECTIONS

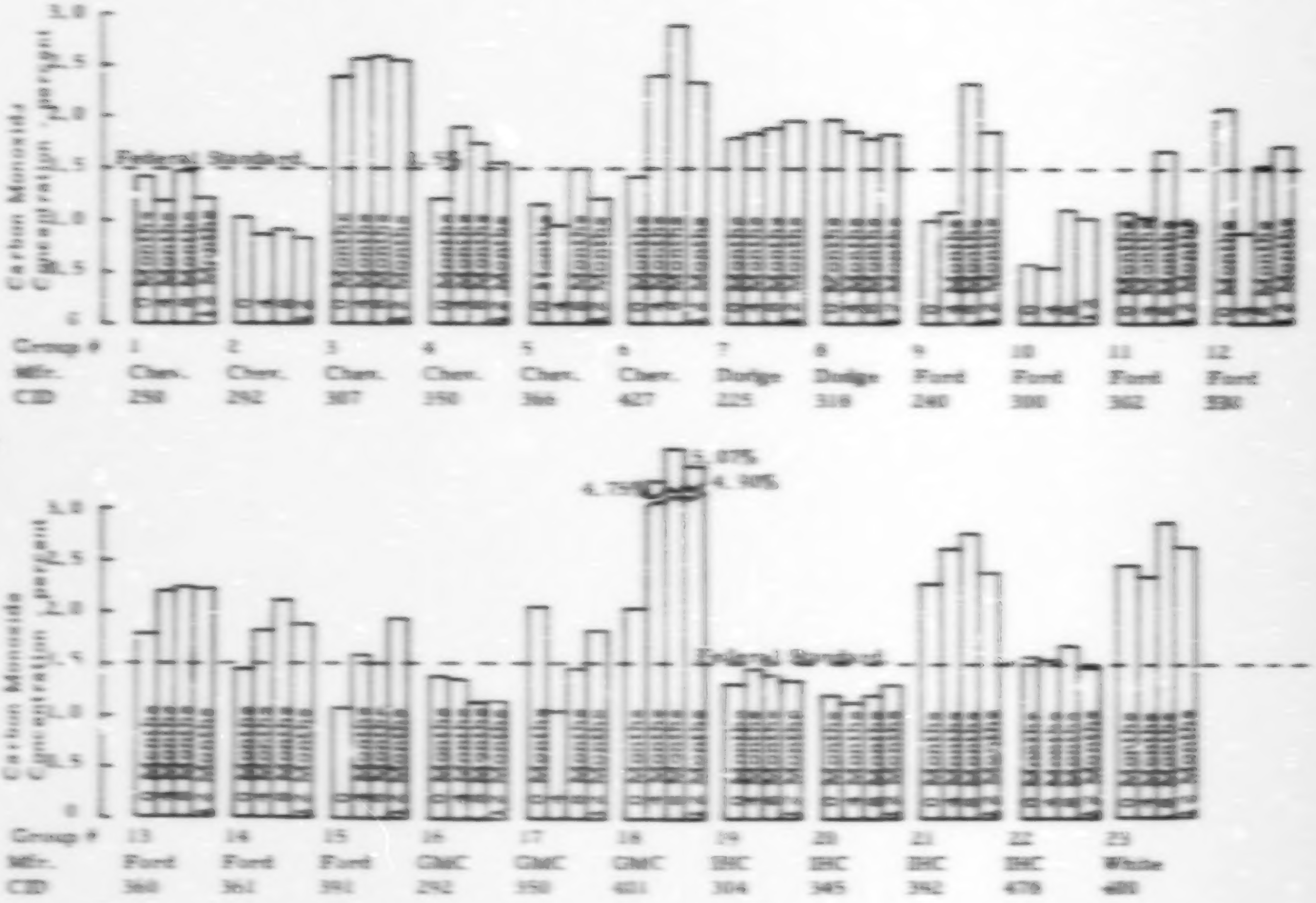


FIGURE 19. EXHAUST CARBON MONOXIDE AVERAGE EMISSION LEVELS FOR THE 23 ENGINE MODEL GROUPS COMPRISING THE SURVEILLANCE FLEET. 0,4,8,AND 12 MONTH INSPECTIONS

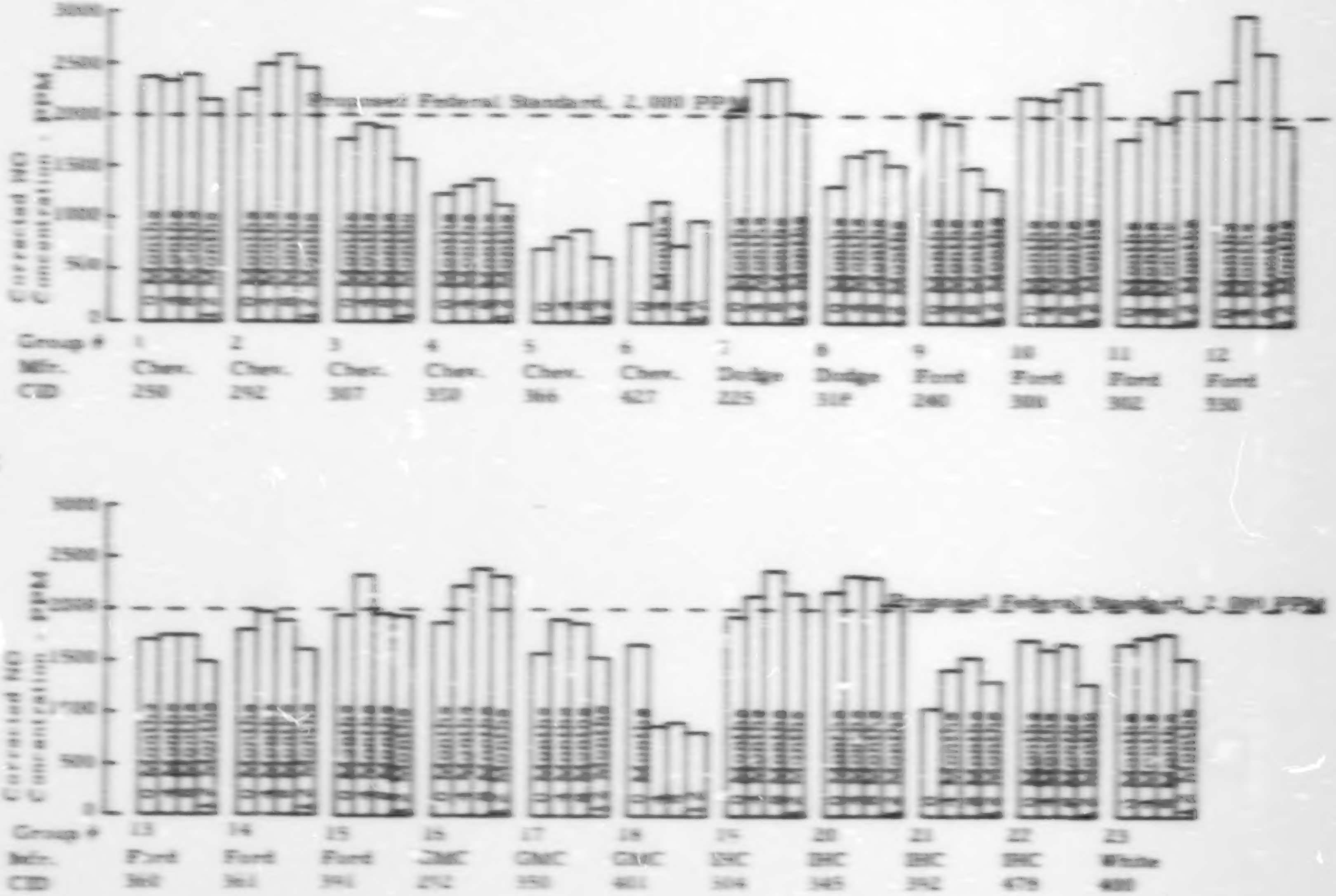


FIGURE 20. EXHAUST CORRECTED NITRIC OXIDE AVERAGE EMISSION LEVELS FOR THE 23 ENGINE MODEL GROUPS COMPRISING THE SURVEILLANCE FLEET. 0, 4, 8, AND 12 MONTH INSPECTIONS

3. Effects of Mileage and Time in Service

As can be seen from the Table 5, in twelve months of operation average HC level has increased about 14 percent, average CO about 11 percent, and average corrected NO approximately less than one percent. Figures 18 to 30 indicate, however, that there is no clear trend for any of the emissions with test time. While the emission levels increased for the entire fleet over the twelve months, the level for some engine models remained the same, and for some the emission level decreased. For many engine groups there was little change in emission level from round to round.

Caution should be used in extending the changes between rounds to changes with mileage and service, since within each engine group there is generally a wide truck-to-truck variation in mileage and time in service. The most notable exception to this is group 23, the five White Motor Company tractors with 400 CID 6 cylinder engines. These trucks all started out at about 9250 miles and have had mileages within 600 miles of each other at each inspection round.

Even in this group, however, round-to-round comparisons do not necessarily show the effects of mileage on emission level, since one truck with extremely high or low emission levels during one test round can unduly affect the average.

For example, while the group average HC level increased from 154 ppm to 202 ppm (31% increase) over the odometer range from 10,000 to 30,000 miles, examining the individual truck results shows that for two trucks the HC level decreased slightly, for two trucks it increased slightly, and for one truck it increased greatly. Thus, while the majority of the trucks in the group showed essentially no change in HC levels between 10,000 and 30,000 miles, the average HC value increased because of the very large increase of one truck. A similar check can be made for CO and NO emission levels. The results show that regardless of the group average, the majority of the trucks in the model group showed little change in CO or NO emission levels between 10,000 miles and 30,000 miles.

In an effort to define emissions changes with mileage in a more exact manner for the entire surveillance fleet, a method of normalizing the emission test results has been developed. This method will allow the use of each individual truck's results with all other trucks to determine emission trends with mileage, despite large differences in absolute levels of emissions from truck to truck. A computer program is used to calculate the percentage change of each exhaust emission with total mileage for each vehicle within an engine model group. The percentage change is based on a common mileage for each engine group and is defined as the highest mileage for any vehicle in the group at the time of the initial test round. This definition was chosen to avoid having to extrapolate data trends, since all vehicles will eventually reach the base mileage. The computer program first finds the equations of the straight lines joining the emission results from the four inspection tests for each truck within a given engine group. This is done for HC, CO, observed NO, and corrected NO. There will be three equations for the three lines connecting the four data points. Using these equations, the emission value at the base mileage is then calculated for each vehicle. The percentage difference between this base emission value and the emission results from each round of testing is then calculated. The percentage difference at each round can then be analysed as a function of mileage.

This analysis has been completed for engine model groups where all engines have reached the base mileage by the fourth inspection round. It was decided to analyse the results by engine model group since engine model had been shown to be a significant variable in explaining the data range within an inspection round. The possibility that emission trends with mileage might vary from engine model to engine model could then also be investigated. Where a truck was out of specification for timing and idle speed when tested and then tested "in spec", the "in spec" results were used for this analysis in order to eliminate one of the many variables that affect emissions. Plots of the percentage change in emissions with odometer miles for these engine groups are presented in Appendix F.

Table 6 summarises the trends shown on these plots. This analysis again emphasizes the difficulty in arriving at any general conclusions about emission level change with time and mileage. However, some generalization can be made. Hydrocarbons appear to change little from 0 to 10,000 miles and then to increase slightly from 10,000 to 30,000 miles for most engine groups. It is significant that the HC level does not ordinarily double or triple as mileage accumulates except in rare isolated cases. In almost all these cases the cause was found to be some mechanical failure which led to incomplete combustion and not the result of general engine wear. The carbon monoxide trend varied from engine model to engine model and exhibited the largest data scatter. Several of the engine models showed CO level increases of 100 percent or more after 30,000 miles. It should also be pointed out that there were engine models that showed either no change or a decrease in CO levels with increasing mileage. The corrected NO emission levels showed the most consistent trend and also had the smallest amount of data scatter. This seems to indicate that the Ethyl humidity correction factor used in correcting the observed NO levels does indeed help account for humidity differences between tests. The corrected NO levels, in general, showed a small decrease from 0 to 30,000 miles. Again, it is significant that only a few trucks had NO emission levels that changed as much as 100 percent.

TABLE 6. ENGINE MODEL GROUP EMISSION TRENDS WITH MILEAGE

Engine Model Group Number	No. of Trucks in Group	Emission Trend With Mileage		
		Hydrocarbons	Carbon Monoxide	Corrected Nitric Oxide
1	4	Increases slightly to 7000 miles, then decreases to 15,000 miles	Increases to about 7000 miles, then decreases to 15000 miles	Decreases slightly from 0 to 15,000 miles
2	2	No change from 0 to 10,000 miles	No change from 0 to 10,000 miles	Increases slightly from 0 to 10,000 miles
4	7	Decreases slightly from 0 to 25,000 miles	Generally decreases from 0 to 25,000 miles. (Data very scattered)	Increases slightly from 0 to 15,000 miles, then decreases moderately to 25,000 miles
5	2	No trend evident. less than 5000 miles on both vehicles	No trend evident	No trend evident
7	6	No trend evident	Increases about 60% from 0 to 50,000 miles	Increases about 50% from 0 to 30,000 miles, then decreases some from about 30,000 to 50,000 miles
9	3 (2 after 3rd round)	Increases slightly from 10,000 to 30,000 miles	Increases over 100% from 10,000 to 30,000 miles	Decreases slightly from 10,000 to 30,000 miles

TABLE 6. (CONT'D) ENGINE MODEL GROUP EMISSION TRENDS WITH MILEAGE

11	1		Only One Truck	
12	4	Increases slightly from 10,000 to 30,000 miles	No change from 10,000 to 30,000 miles	Decreases slightly from 10,000 to 30,000 miles
14	3	Increases slightly from 10,000 to 30,000 miles	Increases 100% from 10,000 10,000 to 30,000 miles	Decreases slightly from 10,000 to 30,000 miles
15	4	No change from 0 to 15,000 miles	Increases about 60% from 0 to 15,000 miles	Increases slightly from 0 to 7500 miles, then decreases moderately to 15,000 miles
17	2	No trend evident	No trend evident	No trend evident
18	1		Only One Truck	
21	23 (21 after 3rd round)	No trend evident	No trend evident	No trend evident
22	7	No change from 0 to 20,000 miles, no trend evident from 20,000 to 35,000 miles	Decreases slightly from 0 to 35,000 miles	No change from 0 to 35,000 miles
23	5	Increases moderately from 10,000 to 20,000 miles, decreases moderately from 20,000 to 30,000 miles	No change from 10,000 to 30,000 miles	Decreases slightly from 10,000 to 30,000 miles

V. CONCLUSIONS

A. Stationary-to-Chassis Dynamometer Correlation Tests

From the nine-mode FTP tests of engines on both the chassis and stationary engine dynamometer, the following conclusions are drawn:

1. There is no one factor that will correlate the results of chassis and stationary engine dynamometer FTP tests. The agreement varied from engine to engine and for each emission. The difference between emission levels obtained from the two test methods normally ranged between +25% and -25%. More than half of the test results agreed within +15% to -15%.

2. The generally close agreement between chassis and stationary test methods demonstrated by the correlation tests validated using the chassis dynamometer version of the Federal Test Procedure in surveillance testing and comparing the fleet averages to Federal standards. However, chassis test results from individual trucks should not be compared to Federal standards on a pass-or-fail basis.

3. Though the stationary engine dynamometer test is the legal certification test method, the chassis dynamometer test is more realistic and indicative of how the engines perform in actual day-to-day vehicle operation.

B. Surveillance Tests

From the analysis of the first four inspection rounds, the following conclusions are drawn:

1. The majority of the surveillance fleet had hydrocarbon emission levels within the 1970 Federal standards of 275 ppm hexane for all four inspections. Nitric oxide emission levels for the majority of the fleet were within the proposed (but not adopted) 1973 limit of 2000 ppm for all four inspection rounds. The majority of the fleet had CO levels exceeding the 1970 Federal standards of 1.5 percent for all four inspection rounds.

2. The fleet average emission level for each emission type increased slightly during the first four inspection rounds.

3. The first four rounds of surveillance inspection have shown a large range of exhaust emission levels for HC, CO, and NO within each inspection round. Engine model is the most significant factor in explaining this emission level range within any test round.

4. The number of cylinders in an engine correlate with NO level differences within each inspection round. In general, 6 cylinder engines have higher NO levels than 8 cylinder engines.

5. Spark timing has a definite effect on NO levels. Engines with timing set earlier than manufacturers specifications showed higher levels of NO than when these same engines were adjusted to manufacturers specifications.

6. Changes in emission levels with mileage varied with the contaminant considered, engine model, and other undefined factors. While many individual truck results ran counter to the general trend, in general, hydrocarbons increased slightly between 0 and 30,000 miles and corrected NO decreased slightly over the same mileage span. A general trend for CO was not discerned, however, many engine models seemed to show an increase in CO; several models showing over 100 percent increase from 0 to 30,000 miles.

7. The results of the surveillance tests to date indicate that contrary to popular brief, exhaust emission from trucks do not always increase with increasing mileage.

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4. Olsen, R. W. and Springer, K. J., "Exhaust Emissions from Heavy-Duty Vehicles," SAE Paper No. 690764, presented at the National Combined Fuels and Lubricants and Transportation Meetings, Houston, Texas, November 4-7, 1969.

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10. Federal Register, Vol. 36, No. 193, Department of Health, Education and Welfare, October 5, 1971, p. 19400.

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APPENDIX A

DESCRIPTIONS OF VEHICLES TESTED

TABLE A-1. DESCRIPTION OF STATIONARY-TO-CHASSIS CORRELATION TEST TRUCKS

No.	Year	Make	GVW	CID	Cyl.	Body	Date	Mileage	Source
1.	1970	Ford	10,000	300	6	Stake	8-71	8,200	Hertz
2.	1970	Ford	7,500	240	6	Pickup	8-71	22,500	Hertz
3.	1969	Dodge	23,000	318	V8	Stake	9-71	33,500	O. R. Mitchell
4.	1970	White	30,000	400	6	Tractor	11-71	25,300	ABC
5.	1971	Ford	23,000	330	V8	Stake	11-71	800	Hertz
6.	1970	Chev	18,000	350	V8	Van	11-71	11,300	E Z Haul
7.	1970	IHC	16,000	345	V8	Van	12-71	9,800	ABC
8.	1971	IHC	32,000	478	V8	Tractor	1-72	20,200	ABC
9.	1970	Chev	14,000	292	6	Van	1-72	5,000	City Parks & Rec. Dept
10.	1971	IHC	26,000	392	V8	Maint.	2-72	83	CPSB

TABLE A-2. DESCRIPTION OF SURVEILLANCE FLEET

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

TABLE A-2. DESCRIPTION OF SURVEILLANCE FLEET (CONT)

Unit No.	Date Tested	Truck No.	Source	Vehicle Year	Make	Engine CID	Cyl.	Trans. Speeds	GVW lbs.	Vehicle Type	Odom. Mileage
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

TABLE A-2. DESCRIPTION OF SURVEILLANCE FLEET (CONT)

[illegible]

Table A-3.

Gasoline Surveillance Fleet Make and CID Categories

Category	No. of Vehicles	Make	CID	Cyl	Source	GVW	Unit Numbers
1	4	Chevrolet	250	6	C.P.S.B.	7,500	31, 32, 36, 37
2	2	Chevrolet	292	6	C.P.S.B.	9,000	30
				6	City P&R	14,000	94
3	11	Chevrolet	307	V8	C W B	7,500	60, 61, 65
				V8	Lone Star	6,600	80
				V8	City P&R	7,500	104, 107, 110, 111
				V8	City P&R	10,000	108, 109, 112
4	7	Chevrolet	350	V8	JFC	24,000	145, 146, 147, 148, 149, 150, 152
5	2	Chevrolet	366	V8	C. W B	12,000	62, 63
6	2	Chevrolet	427	V8	Southern	12,500	103, 151
7	8	Dodge	225	6	State Hosp.	7,500	75, 76, 77, 88
				6	State Hosp.	10,000	86, 87, 89, 90
8	15	Dodge	318	V8	P.O.D.	7,000	125, 126
				V8	Pearl	7,500	53, 118, 119, 120
				V8	C W B	7,500	66, 67
				V8	P.O.D.	10,000	1, 2, 3, 4, 5,
				V8	Red Arrow	24,000	64, 65
9	3	Ford	240	6	Hertz	7,500	21
				6	B.C.R.D.	7,500	96, 97
10	17	Ford	300	6	Pearl	7,500	54
				6	Hertz	10,000	20
				6	C.P.S.B.	10,000	27, 28, 29
				6	C.P.S.B.	16,000	39, 40, 41, 42, 43, 44, 45
				6	Herder	21,000	81, 82
				6	Brown Exp.	24,000	33, 34, 35
11	1	Ford	302	V8	State Hosp.	6,800	78
12	4	Ford	330	V8	B.C.R.D.	21,000	98, 99, 100, 101

Table A-3. Gasoline Surveillance Fleet Make and CID Categories (Cont)

Category	No. of Vehicles	Make	CID	Cyl	Source	GVW	Unit Numbers
13	5	Ford	360	V8	B.M.W.	6,100	102
				V8	B.M.W.	7,500	93
				V8	City P&R	8,300	92, 95, 106
14	3	Ford	361	V8	Herder	22,000	83, 84
				V8	C.W.B.	25,500	68
15	4	Ford	391	V8	Lone Star	27,500	127, 128, 129, 141
16	5	GMC	292	6	Pearl	7,500	52
				6	Pace	10,000	121, 122, 123, 124
17	2	GMC	350	V8	Elmore	10,000	117
				V8	Elmore	14,000	116
18	1	GMC	401	V6	State Hosp.	27,000	79
19	13	IHC	304	V8	Pearl	7,500	51
				V8	C.W.B.	10,000	49, 50
				V8	C.P.S.B.	14,000	26, 38
				V8	C.P.S.B.	19,700	46
				V8	C.W.B.	19,700	47, 48, 55, 56, 57 58, 59
20	8	IHC	345	V8	City P&R	19,000	91
				V8	N.S.S.D.	22,000	18, 19
				V8	C.P.S.B.	25,000	71, 72
				V8	N.S.S.D	25,500	15, 16, 17
21	23	IHC	392	V8	C.P.S.B.	24,000	113
				V8	C.P.S.B.	25,500	22, 23, 24, 25, 69, 70 73, 74, 114, 115
				V8	City P&R	25,500	105
				V8	S.A.P.W.	34,000	130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140
22	7	IHC	478	V8	Ryder	32,000	11, 12, 13, 14
				V8	ABC	32,000	142, 143, 144
23	5	White	400	6	ABC	30,000	6, 7, 8, 9, 10

152 Total

Table A-4.

Definitions and Unit Numbers for Variables Used in Surveillance Fleet Statistical Analysis

A. Automatic Transmission versus Conventional

44 Automatic Units: Nos. 1, 2, 3, 4, 5, 20, 21, 22, 23, 24, 25, 66,
67, 69, 70, 73, 74, 78, 85, 86, 87, 88, 89, 90, 94, 113,
114, 115, 118, 119, 120, 125, 126, 130, 131, 132, 133,
134, 135, 136, 137, 138, 139, and 140.
Remaining units are conventional shift transmissions.

B. Type of Application

26 Stop and Go Units: Nos. 1, 2, 3, 4, 5, 15, 16, 17, 18, 19, 118,
119, 120, 125, 126, 130, 131, 132, 133, 134, 135, 136,
137, 138, 139, 140.

22 Line-Haul Tractors: Nos. 6, 7, 8, 9, 10, 11, 12, 13, 14, 79,
103, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151,
152

26 Freight and Related Delivery: Nos. 20, 21, 33, 34, 35, 51, 52,
53, 54, 64, 65, 80, 81, 82, 83, 84, 116, 117, 121, 122,
123, 124, 127, 128, 129, 141

25 Large Service Trucks (24,000-lb GVW and Above): Nos. 22, 23,
24, 25, 42, 44, 49, 50, 62, 63, 68, 69, 70, 71, 72, 73
74, 98, 99, 100, 101, 105, 113, 114, 115.

20 Medium Service Trucks (Greater than 10,000 but less than 24,000 GVW):
Nos. 26, 27, 28, 29, 38, 39, 40, 41, 43, 45, 46, 47, 48,
55, 56, 57, 58, 59, 91, 94.

33 Small Service Trucks (10,000-lb and less): Nos. 30, 31, 32, 36,
37, 60, 61, 66, 67, 75, 76, 77, 78, 85, 86, 87, 88, 89,
90, 92, 93, 95, 96, 97, 102, 104, 106, 107, 108, 109,
110, 111, 112.

Table A-4.

Definitions and Unit Numbers for Variables Used in Surveillance Fleet Statistical Analysis (Con't)

C. Gross Vehicle Weight

62 Large Trucks (24,000-lb and above): Nos. 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 22, 23, 24, 25, 33, 34, 35, 62, 63, 64, 65, 68, 69, 70, 71, 72, 73, 74, 79, 103, 105, 113, 114, 115, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152.

58 Medium Trucks (Greater than 10,000 but less than 24,000-lb): Nos. 1, 2, 3, 4, 5, 18, 19, 20, 26, 27, 28, 29, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 55, 56, 57, 58, 59, 81, 82, 83, 84, 86, 87, 89, 90, 91, 94, 98, 99, 100, 101, 108, 109, 112, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126.

32 Small Trucks (Less than 10,000 but greater than 6,000-lb): Nos, 21, 30, 31, 32, 36, 37, 51, 52, 53, 54, 60, 61, 66, 67, 75, 76, 77, 78, 80, 85, 88, 92, 93, 95, 96, 97, 102, 104, 106, 107, 110, 111.

D. Vehicle Mileage at Start of Test (Zero Month)

50 Units with 0-499 miles: Nos. 1, 2, 3, 4, 5, 11, 12, 22, 23, 24, 25, 26, 27, 28, 33, 34, 35, 41, 42, 69, 70, 71, 72, 73, 74, 90, 91, 113, 114, 115, 118, 119, 120, 125, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 145, 147, 148.

47 Units with 500-3499 miles: Nos. 13, 14, 29, 31, 32, 36, 37, 38, 39, 40, 43, 44, 45, 46, 49, 57, 58, 59, 60, 62, 63, 76, 77, 78, 79, 86, 87, 89, 92, 94, 95, 103, 105, 106, 107, 108, 109, 124, 126, 127, 141, 143, 144, 146, 149, 150, 152.

35 Units with 3500-9,999 miles: Nos. 6, 7, 8, 9, 10, 15, 16, 17, 18, 19, 20, 21, 30, 47, 48, 50, 53, 55, 56, 61, 66, 67, 68, 75, 88, 93, 97, 100, 110, 111, 121, 122, 123, 142, 151.

20 Units with 10,000 miles and above: Nos. 51, 52, 54, 64, 65, 80, 81, 82, 83, 84, 85, 96, 98, 99, 101, 102, 104, 112, 116, 117.

APPENDIX B

CORRELATION GROUP
DATA SUMMARY FOR INDIVIDUAL TRUCKS

9 MODE FEDERAL CYCLE
TABLE B-1. STATIONARY-CHASSIS DYNAMOMETER EMISSION TEST RESULTS
Correlation Truck No. 1

Engine: Ford 300 CID, 6 Cyl. Vehicle: 1970 Ford, 10,000-lb GVW Stake

Date	Test	Dynamometer	HC ppm n Hex	CO %	NO ppm Obs	NO ppm Corr
8-5-71	1	Stationary	156	1.41	2074	2319
8-6-71	1	"	165	1.36	2067	2276
8-6-71	2	"	161	1.43	2084	2294
	Average		161	1.40	2076	2296
	Spread: $\left(\frac{Max-Min}{Avg}\right)$ X 100		5.6%	5.0%	0.8%	1.9%
8-11-71	1	Chassis	182	1.04	1716	1704
8-11-71	2	"	179	1.07	1807	1794
8-11-71	3	"	184	1.09	1719	1707
	Average		182	1.07	1747	1735
	Spread: $\left(\frac{Max-Min}{Avg}\right)$ X 100		2.8%	4.7%	5.2%	5.2%
	Average Stationary		161	1.40	2076	2296
	Average Chassis		182	1.07	1747	1735
	Difference*		21	-0.33	-329	-561
	Percent Difference**		13	-23.6	-15.9	-24.5

*(Chassis - Stationary)

**(Chassis - Stationary) ÷ Stationary X 100

TABLE B-2. STATIONARY-CHASSIS DYNAMOMETER EMISSION TEST RESULTS
Correlation Truck No. 2

Engine: Ford 240 CID, 6 cyl. Vehicle: 1970 Ford, 7,500-lb GVW Pickup

Date	Test	Dynamometer	HC ppm n. Hex	CO %	NO, ppm Obs.	NO, ppm Corr.
8-24-71	2	Chassis	182	.626	1966	1952
8-25-71	3	"	175	.707	1797	1763
8-26-71	1	"	174	.662	1979	1987
8-26-71	2	"	177	.631	1958	1965
Average			177	.657	1925	1917
Spread: ($\frac{Max-Min}{Avg}$) X 100			4.5%	12.3%	9.4%	11.7%
9-2-71	1	Stationary	157	.560	1227	1384
9-2-71	2	"	152	.464	1394	1572
9-2-71	3	"	140	.423	1373	1549
Average			150	.482	1331	1502
Spread: ($\frac{Max-Min}{Avg}$) X 100			11.3%	28.4%	12.5%	12.5%
9-21-71	1	Stationary	139	.456	1653	1685
9-21-71	2	"	139	.454	1648	1694
9-21-71	3	"	143	.510	1669	1715
Average			140	.473	1657	1698
Spread: ($\frac{Max-Min}{Avg}$) X 100			2.9%	11.8%	1.3%	1.8%
9-27-71	2	Chassis	169	.629	1464	1480
9-27-71	3	"	165	.663	1366	1381
9-27-71	4	"	168	.635	1394	1409
Average			167	.642	1408	1423
Spread: ($\frac{Max-Min}{Avg}$) X 100			2.4%	5.3%	7.0%	7.0%
Average Stationary			143	.478	1494	1600
Average Chassis			172	.650	1703	1705
Difference*			29	.172	209	105
Percent Difference**			20.3	36.0	14.0	6.6

*(Chassis - Stationary

**(Chassis - Stationary) ÷ Stationary X 100

TABLE B-3. STATIONARY-CHASSIS DYNAMOMETER EMISSION TEST RESULTS
Correlation Truck No. 3

Engine: Dodge 318 CID V8

Vehicle: 1969 Dodge, 21,000 lb GVW
Stake

Date	Test	Dynamometer	HC ppm n. Hex.	CO %	NO, ppm Obs.	NO, ppm Corr.
10-12-71	1	Chassis	310	3.319	1624	1556
10-12-71	2	"	279	3.243	1625	1557
10-12-71	4	"	290	3.355	1696	1625
	Average		293	3.306	1648	1579
	Spread	$(\frac{Max-Min}{Avg}) \times 100$	10.6%	3.4%	4.4%	4.4%
10-19-71	2	Stationary	308	4.741	1338	1513
10-20-71	1	"	294	4.437	1525	1429
10-20-71	2	"	296	4.353	1728	1662
10-20-71	3	"	288	4.183	1716	1665
	Average		297	4.429	1577	1567
	Spread	$(\frac{Max-Min}{Avg}) \times 100$	6.7%	12.6%	24.7%	15.1%

	HC ppm n. Hex.	CO %	NO, ppm Obs.	NO, ppm Corr.
Average Stationary	297	4.429	1577	1567
Average Chassis	293	3.306	1648	1579
Difference*	-4	-1.123	71	12
Percent Difference**	-1.3	-25.3	4.5	0.8

*(Chassis - Stationary)
**(Chassis - Stationary) ÷ Stationary X 100

TABLE B-4. STATIONARY-CHASSIS DYNAMOMETER EMISSION TEST RESULTS

Correlation Truck No. 4

Engine: White 400 CID, 6 Cyl.

Vehicle: 1970 White, 30,000-lb GVW Tractor

Date	Test	Dynamometer	HC ppm n. Hex.	CO %	NO_x, ppm Obs.	NO_x, ppm Corr
11-23-71	1	Stationary	157	1.74	1614	1456
11-23-71	2	Stationary	163	1.73	1647	1486
11-23-71	3	Stationary	169	1.66	1583	1450
11-23-71	4	Stationary	161	1.66	1651	1506
	Average		163	1.70	1624	1475
	Spread $\left(\frac{\text{Max-Min}}{\text{Avg}}\right) \times 100$		7.4%	4.7%	4.2%	3.8%
11-8-71	2	Chassis	206	2.38	1792	1641
11-9-71	1	Chassis	204	2.39	1577	1511
11-9-71	2	Chassis	211	2.48	1747	1680
	Average		207	2.41	1705	1611
	Spread $\left(\frac{\text{Max-Min}}{\text{Avg}}\right) \times 100$		3.4%	4.0%	12.6%	10.4%
	Average Stationary		163	1.70	1624	1475
	Average Chassis		207	2.41	1705	1611
	Difference*		+44	+0.71	+81	+136
	Percent Difference**		+27.0	+41.8	+5.0	+9.2

*(Chassis - Stationary)

**(Chassis - Stationary) ÷ Stationary X 100

TABLE B-5. STATIONARY-CHASSIS DYNAMOMETER EMISSION TEST RESULTS
Correlation Truck No. 5

Engine: Ford 330 CID V8

Vehicle: 1971 Ford 23,000 lb. GVW Van

Date	Test	Dynamometer	HC ppm n-Hex.	CO %	NO, ppm	
					Obs.	Corr.
12/6/71	1	Stationary	188	1.121	1306	1117
12/6/71	2	Stationary	191	1.293	1273	1088
12/6/71	3	Stationary	186	1.114	1393	1185
	Average		188	1.176	1324	1130
	Spread $\left(\frac{\text{Max-Min}}{\text{Avg}}\right) \times 100$		2.6%	14.6%	9.1%	8.6%
11/11/71	1	Chassis	225	1.061	1414	1290
11/11/71	2	Chassis	213	1.006	1441	1326
11/11/71	3	Chassis	216	1.045	1454	1338
	Average		218	1.037	1436	1318
	Spread $\left(\frac{\text{Max-Min}}{\text{Avg}}\right) \times 100$		5.5%	5.3%	2.8%	3.6%
	Average Stationary		188	1.176	1324	1130
	Average Chassis		216	1.037	1436	1318
	Difference*		+28	-.139	+112	+188
	Percent Difference**		+15.0	-11.8	+8.4	16.6

* (Chassis-Stationary)
** (Chassis-Stationary) ÷ Stationary X 100

TABLE B-6. STATIONARY-CHASSIS DYNAMOMETER EMISSION TEST RESULTS
Correlation Truck No. 6

Engine: Chevrolet 350 CID V8 Vehicle: 1970 Chevrolet 18,000 lb. GVW Van

Date	Test	Dynamometer	ppm n. Hex	CO %	NO, ppm Obs.	NO, ppm Corr.
12/10/71	1	Stationary	125	1,782	926	806
12/10/71	2	Stationary	131	1,788	912	847
12/10/71	3	Stationary	130	1,753	940	781
	Average		129	1,774	926	811
	Spread $\left(\frac{\text{Max-Min}}{\text{Avg}}\right)$ X 100		4.7%	2.0%	3.0%	8.1%
11/23/71	1	Chassis	130	2,020	872	759
11/24/71	1	Chassis	129	1,940	880	770
11/24/71	2	Chassis	130	2,009	856	732
	Average		130	1,990	869	754
	Spread $\left(\frac{\text{Max-Min}}{\text{Avg}}\right)$ X 100		0.8%	4.0%	2.8%	5.0%
	Average Stationary		129	1,774	926	811
	Average Chassis		130	1,990	869	754
	Difference*		1	.216	-57	-57
	Percent Difference**		.8%	12.2%	-6.1%	-7.0%

* (Chassis-Stationary)
** (Chassis-Stationary) ÷ Stationary X 100

TABLE B-7. STATIONARY-CHASSIS DYNAMOMETER EMISSION TEST RESULTS
Correlation Truck No. 7

Engine: IHC 345 CID   Vehicle: 1970, 16,000-lb GVW Van

Date	Test	Dynamometer	HC ppm n. Hex.	CO %	NO, ppm Obs.	NO, ppm Corr.
1/4/72	1	Stationary	273	1.714	2900	2276
1/4/72	2	Stationary	253	1.545	2849	2295
1/4/72	3	Stationary	244	1.585	2819	2165
	Average		257	1.614	2856	2245
	Spread ($\frac{\text{Max-Min}}{\text{Avg}}$) X 100		11.3%	10.5%	2.8%	5.8%
12/16/71	1	Chassis	209	2.075	2359	2140
12/16/71	2	Chassis	205	2.016	2369	2229
12/16/71	3	Chassis	209	2.134	2296	2252
	Average		208	2.075	2341	2207
	Spread ($\frac{\text{Max-Min}}{\text{Avg}}$) X 100		1.9%	5.5%	3.1%	5.1%
	Average Stationary		257	1.614	2856	2245
	Average Chassis		208	2.075	2341	2207
	Difference*		-49	0.461	-515	-38
	Percent Difference**		-19.1	28.6	-21.9	-1.7

*(Chassis-Stationary)
**(Chassis-Stationary) ÷ Stationary X 100

TABLE B-8. STATIONARY-CHASSIS DYNAMOMETER EMISSION TEST RESULTS
Correlation Truck No. 8

Engine: IHC 478 CID, V-8

Vehicle: IHC 32,000-lb GVW
Tractor

Date	Test	Dynamometer	HC ppm n. Hex.	CO %	NO_x, ppm Obs.	NO_x, ppm Corr.
1/19/72	1	Stationary	218	1.576	1629	1691
1/19/72	2	Stationary	209	1.571	1593	1679
	Average		214	1.574	1611	1685
	Spread $\left(\frac{\text{Max-Min}}{\text{Avg}}\right) \times 100$		4.2%	0.3%	2.2%	0.7%
12/30/71	3	Chassis	231	1.394	1731	1438
12/30/71	4	Chassis	223	1.404	1627	1352
	Average		227	1.399	1679	1395
	Spread $\left(\frac{\text{Max-Min}}{\text{Avg}}\right) \times 100$		3.5%	0.7%	6.2%	6.2%
	Average Stationary		214	1.574	1611	1685
	Average Chassis		227	1.399	1679	1395
	Difference*		13	-.175	68	-290
	Percent Difference**		6.1	-11.1	4.22	-17.2

*(Chassis-Stationary)
**(Chassis-Stationary) ÷ Stationary × 100

TABLE B-9. STATIONARY-CHASSIS DYNAMOMETER EMISSION TEST RESULTS
Correlation Truck No. 9

Engine: Chevy 292 CID, 6 cyl.

Vehicle: 1970 14,000-lb GVW
Step-in Van

Date	Test	Dynamometer	HC ppm n. Hex.	CO %	NOx ppm Obs.	NOx ppm Corr.
1/25/72	1	Stationary	182	.979	3486	2879
1/25/72	2	Stationary	190	1.040	3527	2786
	Average		186	1.010	3506	2833
	Spread $\left(\frac{\text{Max-Min}}{\text{Avg}}\right) \times 100$		4.3%	6.0%	1.16%	3.28%
1/21/72	1	Chassis	162	.913	3518	3148
1/21/72	2	Chassis	161	.810	3469	3049
	Average		161.5	.901	3494	3099
	Spread $\left(\frac{\text{Max-Min}}{\text{Avg}}\right) \times 100$		0.6%	11.4%	1.4%	3.19%
	Average Stationary		186	1.010	3506	2833
	Average Chassis		162	.910	3494	3099
	Difference*		-24	-.100	-22	266
	Percent Difference**		-12.9	-9.9	-0.6	9.38

*(Chassis-Stationary)
**(Chassis-Stationary) ÷ Stationary X 100

TABLE B-10. STATIONARY-CHASSIS DYNAMOMETER EMISSION TEST RESULTS

Correlation Truck No. 10

Engine: IHC 392 CID V8

Vehicle: 1971 IHC 26,000-lb GVW
Power Line Maintenance Truck

Date	Test	Dynamometer	HC ppm n. Hex.	CO %	NO, ppm Obs.	NO, ppm Corr.
2/7/72	1	Stationary	192	1.24	1527	1206
2/7/72	2	Stationary	206	1.41	1673	1322
2/7/72	4	Stationary	213	1.37	1558	1231
		Average	204	1.34	1586	1253
Spread	$\frac{\text{Max-Min}}{\text{Avg}}$	x 100	10.3%	12.9%	9.2%	9.3%
2/1/72	1	Chassis	259	1.43	(1)	
2/1/72	2	Chassis	244	1.40	1487	1258
2/1/72	3	Chassis	233	1.48	1472	1245
		Average	245	1.44	1479	1252
Spread	$\frac{\text{Max-Min}}{\text{Avg}}$	x 100	10.6%	5.7%	1.0%	1.0%
Average Stationary			204	1.34	1586	1253
Average Chassis			245	1.44	1479	1252
Difference*			41	0.10	-107	-1
Percent Difference**			20.1	7.5	-6.7	-0.1

*Chassis-Stationary

**(Chassis-Stationary) ÷ Stationary X 100

(1)Instrumentation Malfunction.

APPENDIX C

FEDERAL TEST PROCEDURE FOR EXHAUST EMISSION TESTS OF HEAVY DUTY GASOLINE POWERED TRUCKS

(Excerpted from November 10, 1970, Federal Register)

FEDERAL REGISTER

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PART II

Department of Health, Education, and Welfare

Office of the Secretary

•

Control of Air Pollution From New Motor Vehicles and New Motor Vehicle Engines

(4) "Gross vehicle weight" means the manufacturer's gross weight rating.

(5) "Light duty vehicle" means any motor vehicle either designed primarily for transportation of property and rated at 6,000 pounds GVW or less or designed primarily for transportation of persons and having a capacity of 12 persons or less.

(6) "Heavy duty vehicle" means any motor vehicle either designed primarily for transportation of property and rated at more than 6,000 pounds GVW or designed primarily for transportation of persons and having a capacity of more than 12 persons.

(7) "Heavy duty engine" means any engine which the engine manufacturer could reasonably expect to be used for motive power in a heavy duty vehicle.

(8) "Off-road utility vehicle" means a light duty vehicle which incorporates special features for off-road operation such as four-wheel drive.

(9) "Motorcycle" means any light duty vehicle having a seat or saddle for the use of the rider and designed to travel on not more than three wheels (including any tricycle arrangement) in contact with the ground and weighing less than 1,500 pounds.

(10) "Vehicle curb weight" means the actual or the manufacturer's estimated weight of the vehicle in operational status with all standard equipment, and weight of fuel at nominal tank capacity, and the weight of optional equipment computed in accordance with § 85.69(a).

(11) "Loaded vehicle weight" means the vehicle curb weight of a light duty vehicle plus 300 pounds.

(12) "System" includes any motor vehicle engine modification which controls or causes the reduction of substances emitted from motor vehicles or motor vehicle engines.

(13) "Engine family" means the basic classification unit of a manufacturer's product line used for the purpose of test fleet selection and determined in accordance with § 85.68(a).

(14) "Engine-system combination" means an engine family-exhaust emission control system-fuel evaporative emission control system (where applicable) combination.

(15) "Fuel system" means the combination of fuel tank, fuel pump, fuel lines, and carburetor or fuel injection components, and includes all fuel system vents and fuel evaporative emission control systems.

(16) "Crankcase emissions" means airborne substances emitted to the atmosphere from any portion of the crankcase ventilation or lubrication systems.

(17) "Exhaust emissions" means substances emitted to the atmosphere from any opening downstream from the exhaust port of a motor vehicle engine.

(18) "Fuel evaporative emissions" means vaporized fuel emitted into the atmosphere from the fuel system of a motor vehicle.

(19) "Smoke" means the matter in exhaust emissions which obscures the transmission of light.

(20) "Hot soak loss" means fuel evaporative emissions during the 1-hour hot soak period which begins immediately after the engine is turned off.

(21) "Diurnal breathing loss" means fuel evaporative emissions as a result of the daily range in temperature to which the fuel system is exposed.

(22) "Running loss" means fuel evaporative emissions resulting from an average trip in an urban area or the simulation of such a trip.

(23) "Tank fuel volume" means the volume of fuel in the fuel tank prescribed to be 40 percent of nominal tank capacity rounded to the nearest whole U.S. gallon.

(24) "Maximum rated horsepower" means the maximum brake horsepower output of an engine as stated by the manufacturer in his sales and service literature and his application for certification under § 85.61.

(25) "Rated speed" means the speed at which the manufacturer specifies the maximum rated horsepower of an engine.

(26) "Maximum rated torque" means the maximum torque produced by an engine as stated by the manufacturer in his sales and service literature and his application for certification under § 85.61.

(27) "Opacity" means the fraction of a beam of light, expressed in percent, which fails to penetrate a plume of smoke.

(28) Zero (0) miles means that point after initial engine starting (not to exceed 50 miles of vehicle operation) at which adjustments are completed.

(29) Zero (0) hours means that point after initial engine starting (not to exceed 1 hour of engine operation) at which adjustments are completed.

(30) "Calibrating gas" means a gas of known concentration which is used to establish the response curve of an analyzer.

(31) "Span gas" means a gas of known concentration which is used routinely to set the output of an analyzer.

§ 85.2 Abbreviations.

The abbreviations used in this part have the following meanings in both capital and lower case:

Accel.—Acceleration.
ASTM—American Society for Testing and Materials.
BHP—Brake Horsepower.
CFH—Cubic feet per hour.
CO—Carbon monoxide.
CO2—Carbon dioxide.
Conc.—Concentration.
CT—Closed Throttle.
CFM—Cubic feet per minute.
Cu. in.—Cubic inch(es).
Decel.—Deceleration.
EP—End Point.
Evap.—Evaporated.
F—Fahrenheit.
FT—Full Throttle.
Gal.—U.S. Gallon(s).
[illegible]
GVW—Gross Vehicle Weight.
HC—Hydrocarbon(s).
Hg—Mercury.
hr.—Hour.
HP—Horsepower.
IBP—Initial Boiling Point.
ID—Internal Diameter.
lb.—Pound(s).
lb.-ft.—Pound-feet.
Max.—Maximum.
Min.—Minimum; also minute(s).
ml.—Milliliter(s).
m.p.h.—Miles per hour.
mm.—Millimeter(s).
N2—Nitrogen.
No.—Number.
Pb—Lead.
p.p.m.—Parts per million by volume.
p.s.i.—Pounds per square inch.
p.s.i.g.—Pounds per square inch gauge.
PTA—Part Throttle Accel.
PTD—Part Throttle Decel.
R—Rankine.
r.p.m.—Revolutions per minute.
RS—Rated Speed.
RVP—Reid Vapor Pressure.
S.A.E.—Society of Automotive Engineers.
sec.—Second(s).
SP—Speed.
SS—Stainless Steel.
T—Torque.
TEL—Tetraethyl Lead.
TML—Tetramethyl Lead.
V—Volts.
Vs.—Versus.
WOT—Wide Open Throttle.
Wt.—Weight.
'—Feet.
"—Inches.
°—Degrees.
%—Percent.

§ 85.3 General standards; increase in emissions; unsafe conditions.

(a) (1) Every new motor vehicle or new motor vehicle engine manufactured for sale, sold, offered for sale, introduced or delivered for introduction into commerce, or imported into the United States for sale or resale which is subject to any of the standards prescribed in this part shall be covered by a certificate of conformity issued pursuant to Subpart F of this part.

(2) No heavy duty vehicle manufacturer shall take any of the actions specified in section 203(a)(1) of the Act with respect to any gasoline fueled or diesel powered heavy duty vehicle which uses an engine which has not been certified as meeting applicable standards. Such manufacturer shall provide to the Secretary prior to the beginning of each model year a statement signed by an authorized representative which includes the following information:

(i) A description of the vehicles which will be produced subject to this section;

(ii) Identification of the engines used in the vehicles;

(iii) Projected sales data on each vehicle-engine combination;

(iv) A statement that the engines will not be modified by the vehicle manufacturer or a detailed specification of any changes which will be made. Changes made solely for the purpose of mounting an engine in a vehicle need not be included.

(b) (1) Any system installed on or incorporated in a new motor vehicle or new motor vehicle engine to enable such vehicle to conform to standards imposed by this part:

(i) Shall not in its operation or function cause the emission into the ambient air of any noxious or toxic substance that would not be emitted in the operation of such vehicle or engine without such system, except as specifically permitted by regulation; and

(ii) Shall not, in its operation, function, or malfunction result in any unsafe condition endangering the motor vehicle, its occupants, or persons or property in close proximity to the vehicle.

(b) Every manufacturer of new motor vehicles or new motor vehicle engines subject to any of the standards imposed by this part shall, prior to taking any of the actions specified in section 203(a)(1) of the Act, test or cause to be tested motor vehicles or motor vehicle engines in accordance with good engineering practice to ascertain that such test vehicles or engines will meet the requirements of this section for the lifetime of the vehicle or engine as defined in § 85.52, § 85.112, or § 85.152, as appropriate.

§ 85.4 Labeling.

(a)(1) The manufacturer of any light duty motor vehicle subject to any of the standards prescribed in this part shall, at the time of manufacture, affix a permanent, legible label of the type and in the manner described below, containing the information hereinafter provided, to all production models of such vehicles available for sale to the public and covered by a certificate of conformity under § [illegible](a).

(2) A plastic or metal label shall be welded, riveted, or otherwise permanently attached in a readily visible position in the engine compartment.

(3) The label shall be affixed by the vehicle manufacturer, who has been issued the certificate of conformity for such vehicle, in such a manner that it cannot be removed without destroying or defacing the label, and shall not be affixed to any equipment which is easily detached from such vehicle.

(4) The label shall contain the following information lettered in the English language in block letters and numerals, which shall be of a color that contrasts with the background of the label:

(i) The label heading: Vehicle Emission Control Information;

(ii) Full corporate name and trademark of manufacturer;

(iii) Engine displacement (in cubic inches) and engine family identification;

(iv) Engine tuneup specifications and adjustments, as recommended by the manufacturer, including idle speed, ignition timing, and the idle air-fuel mixture setting procedure and value (e.g., idle CO, idle air-fuel ratio, idle speed drop). These specifications should indicate the proper transmission position during tuneup and what accessories (e.g., air conditioner), if any, should be in operation;

(v) The statement: "This Vehicle Conforms to U.S. Dept. of H.E.W. Regulations Applicable to (insert current year) Model Year New Motor Vehicles."

(b) The manufacturer of any heavy duty gasoline fueled engine shall, at the time of manufacture, affix a permanent, legible plastic or metal label containing the information hereinafter provided to all production models of such engines available for sale to the public, and covered by a certificate of conformity under § [illegible](a). The label shall be affixed at such a location that it will be readily accessible for inspection after the engine is installed in a vehicle and shall read as follows:

Engine Emission Certification

This engine is in all material respects of substantially the same construction as the engines certified by the U.S. Department of Health, Education, and Welfare as conforming to Federal regulations pertaining to [illegible].

Engine family identification and engine displacement (in cubic inches) ....

Date of manufacture ....

(Month and year)

Name of manufacturer ....

(The information applicable to each engine is to be inserted on the appropriate line.)

(c) The manufacturer of any heavy duty diesel engine shall, at the time of manufacture, affix a permanent, legible plastic or metal label containing the information hereinafter provided to all production models of such engines available for sale to the public, and covered by a certificate of conformity under § [illegible](a). The label shall be affixed at such a location that it will be readily accessible for inspection after the engine is installed in a vehicle and shall read as follows:

Engine Smoke Emission Certification

This engine is in all material respects of substantially the same construction as the engines certified by the U.S. Department of Health, Education, and Welfare as conforming to Federal regulations pertaining to exhaust smoke emission.

Engine family identification and model ....

Date of manufacture ....

(Month and year)

Name of manufacturer ....

(The information applicable to each engine is to be inserted on the appropriate line.)

(d) The provisions of this section shall not prevent a manufacturer from also reciting on the label that such vehicle or engine conforms to any applicable State emission standards for new motor vehicles or new motor vehicle engines or any other information that such manufacturer deems necessary for, or useful to, the proper operation and satisfactory maintenance of the vehicle or engine.

§ 85.5 Submission of vehicle identification numbers.

(a) The manufacturer of any light duty motor vehicle covered by a certificate of conformity under § [illegible](a) shall, not later than 30 days after its manufacture, submit to the Secretary the vehicle identification number of such vehicle: *Provided*, That this requirement shall not apply with respect to any vehicle manufactured within any State, as defined in section 208(d) of the Act.

(b) The requirements of this section may be waived with respect to any manufacturer who provides information satisfactory to the Secretary which will enable the Secretary to identify those vehicles or engines which are covered by a certificate of conformity.

§ 85.6 Production vehicles and engines.

(a) Any manufacturer obtaining certification under this part shall supply to the Secretary, upon his request, a reasonable number of production vehicles or engines selected by the Secretary which are representative of the engines, emission control systems, fuel systems, and transmissions offered and typical of production models available for sale under the certificate. These vehicles or engines shall be supplied for testing at such time and place and for such reasonable periods as the Secretary may require. Engines supplied under this paragraph may be required to be mounted in chassis and appropriately equipped for operation on a chassis dynamometer.

(b) Any manufacturer obtaining certification under this part shall notify the Secretary, on a quarterly basis, of the number of vehicles of each engine family - engine displacement - exhaust emission control system - fuel system - transmission type - inertia weight class combination or the number of engines of each engine family - engine displacement - exhaust emission control system - fuel system combination produced for sale in the United States during the preceding quarter. A manufacturer may elect to provide this information every 60 days instead of quarterly, to combine it with the notification required under § 85.5.

(c) All light duty vehicles covered by a certificate of conformity under § [illegible](a) shall be adjusted by the manufacturer to the engine tuning specification detailed in § 85.4(a)(4)(iv).

§ 85.7 Emission control system operation during test.

All emission control systems installed on or incorporated in a new motor vehicle or new motor vehicle engine shall be functioning during all test procedures in this part.

§ 85.8 Special test procedures.

The Secretary may, on the basis of a written application therefor by a manufacturer, prescribe test procedures, other than those set forth in this part, for any motor vehicle or motor vehicle engine which he determines is not susceptible to satisfactory testing by the procedures set forth herein.

§ 85.9 Maintenance of records; submittal of information; right of entry.

(a) The manufacturer of any new motor vehicle or new motor vehicle engine subject to any of the standards prescribed in this part shall establish and maintain the following adequately organized and indexed records:

(1) Identification and description of all vehicles or engines for which testing is required under this part.

(2) A description of all emission control systems which are installed on or incorporated in each vehicle or engine.

(3) A description of the procedures used to test such vehicles or engines.

(4) Test data on each emission data vehicle or engine that will show its emissions at 0 and 4,000 miles or 0 and 125 hours, respectively.

(3) Test data on each durability vehicle or engine which will show the performance of the systems installed on or incorporated in the vehicle or engine during extended mileage or operation, as well as a record of all pertinent maintenance performed on the vehicle or engine.

(b) The manufacturer of any new motor vehicle or new motor vehicle engine subject to any of the standards prescribed in this part shall submit to the Secretary at the time of issuance by the manufacturer copies of all instructions or explanations regarding the use, repair, adjustment, maintenance, or testing of such vehicle or engine relevant to the control of crankcase, exhaust, or evaporative emissions, issued by the manufacturer for use by other manufacturers, assembly plants, distributors, dealers, and ultimate purchasers: *Provided*, That any material not translated into the English language need not be submitted unless specifically requested by the Secretary.

(c) The manufacturer of any new motor vehicle or new motor vehicle engine subject to any of the standards prescribed in this part shall permit officers or employees duly designated by the Secretary, upon presenting appropriate credentials and a written notice to the manufacturer:

(1) To enter, at reasonable times, any premises used during the certification procedure for purposes of monitoring tests and mileage accumulation procedures, observing maintenance procedures, and verifying correlation of calibration of test equipment, or

(2) To inspect, at reasonable times, records, files, and papers compiled by such manufacturer in accordance with paragraph (a) of this section.

A separate notice shall be given for each such inspection, but a separate notice shall not be required for each entry made during the period covered by the inspection. Each such inspection shall be commenced and completed with reasonable promptness.

Subpart B—Crankcase Emissions (Gasoline Fueled Vehicles and Engines)

§ 85.10 Applicability.

The provisions of this subpart are applicable to all new gasoline fueled light duty vehicles, except motorcycles, and heavy duty engines beginning with the 1972 model year for such vehicles and engines.

§ 85.11 Standard for crankcase emissions.

No crankcase emissions shall be discharged into the ambient atmosphere from any new motor vehicle or new motor vehicle engine subject to this subpart.

§ 85.12 Test procedures.

Every manufacturer of new motor vehicles or new motor vehicle engines subject to the standard prescribed in this subpart shall, prior to taking any of the actions specified in section 203(a)(1) of the Act, test or cause to be tested motor vehicles or motor vehicle engines in accordance with good engineering practice to ascertain that such test vehicles or engines, with proper maintenance, will meet the requirements of § 85.11 for a period not less than 50,000 miles or 1,500 hours, respectively. If, pursuant to § 85.80(a), the Secretary issues a certificate of conformity for the class or classes of motor vehicles or motor vehicle engines represented by such test vehicles or engines, any new motor vehicle or motor vehicle engine which is in all material respects of substantially the same construction as such test vehicle or engine shall be deemed to be in conformity with the requirement of § 85.11.

Subpart C—Exhaust Emissions and Fuel Evaporative Emissions (Gasoline Fueled Light Duty Vehicles)

§ 85.20 Applicability.

The provisions of this subpart are applicable to new gasoline fueled light duty motor vehicles beginning with the model year specified therein, except motorcycles and 1972 model year vehicles with an engine displacement of less than 50 cubic inches.

§ 85.21 Standards for exhaust emissions.

(a) Exhaust emissions from 1972, 1973, and 1974 model year vehicles shall not exceed:

(1) Hydrocarbons—3.4 grams per vehicle mile.

(2) Carbon monoxide—39.0 grams per vehicle mile.

(b) The standards set forth in paragraph (a) of this section refer to the exhaust emitted over a driving schedule as set forth in the applicable sections of "Test Procedures for Vehicle Exhaust and Fuel Evaporative Emissions (Gasoline Fueled Light Duty Vehicles)" of this part and measured and calculated in accordance with those procedures.

§ 85.22 Standard for fuel evaporative emissions.

(a) Fuel evaporative emissions from vehicles beginning with the 1972 model year shall not exceed:

(1) Hydrocarbons—2 grams per test.

(b) The standard set forth in paragraph (a) of this section refers to a composite sample of the fuel evaporative emissions collected under the conditions set forth in the "Test Procedures for Vehicle Exhaust and Fuel Evaporative Emissions (Gasoline Fueled Light Duty Vehicles)" of this part and measured in accordance with those procedures.

§ 85.23 Test procedures.

Every manufacturer of new motor vehicles subject to the standards prescribed in this subpart shall, prior to taking any of the actions specified in section 203(a)(1) of the Act, test or cause to be tested motor vehicles in accordance with test procedures in Subpart H of this part to ascertain that such test vehicles meet the requirements of §§ 85.21 and 85.22, as applicable. If, pursuant to § 85.80(a), the Secretary issues a certificate of conformity for the class or classes of vehicles represented by such test vehicles, any new motor vehicle which is in all material respects of substantially the same construction as such test vehicles shall be deemed to be in conformity with the requirements of §§ 85.21 and 85.22, as applicable.

Subpart D—Exhaust Emissions (Gasoline Fueled Heavy Duty Engines)

§ 85.30 Applicability.

The provisions of this subpart are applicable to new gasoline fueled heavy model year.

§ 85.31 Standards for exhaust emissions.

(a) Exhaust emissions from new gasoline fueled heavy duty engines shall not exceed:

(1) Hydrocarbons—275 p.p.m.

(2) Carbon monoxide—1.5 percent by volume.

(b) The standards set forth in paragraph (a) of this section refer to a composite sample representing the operating cycles set forth in the applicable sections of "Test Procedure for Engine Exhaust Emissions (Gasoline Fueled Heavy Duty Engines)" of this part and measured in accordance with those procedures.

§ 85.32 Test procedures.

Every manufacturer of new motor vehicle engines subject to the standards prescribed in this subpart shall, prior to taking any of the actions specified in section 203(a)(1) of the Act, test or cause to be tested motor vehicle engines in accordance with test procedures prescribed in Subpart I of this part to ascertain that such test engines meet the requirements of § 85.31. If, pursuant to § 85.80(a), the Secretary issues a certificate of conformity for the class or classes of motor vehicle engines represented by such test engines, any new motor vehicle engine which is in all material respects of substantially the same construction as such test engines shall be deemed to be in conformity with the requirements of § 85.31.

Subpart E—Exhaust Emissions (Heavy Duty Diesel Engines)

§ 85.40 Applicability.

The provisions of this subpart are applicable to new heavy duty diesel engines beginning with the 1972 model year.

§ 85.41 Standards for exhaust smoke.

(a) The opacity of smoke emissions from new diesel engines subject to this subpart shall not exceed:

(1) 40 percent during the engine acceleration mode.

(2) 20 percent during the engine lugging mode.

(b) The standards set forth in paragraph (a) of this section refer to exhaust smoke emissions generated under the conditions set forth in the "Test Procedures for Engine Exhaust Emissions (Heavy Duty Diesel Engines)" of this part and measured and calculated in accordance with those procedures.

vehicle available for such testing under § 85.54 as the Secretary may require before beginning to accumulate mileage on the vehicle. Failure to comply with this requirement will invalidate all test data submitted for this vehicle.

(f) Once a manufacturer begins to operate an emission data or durability data vehicle, as indicated by compliance with paragraph (e) of this section, he shall continue to run the vehicle to 4,000 miles or 50,000 miles, respectively, and the data from the vehicle will be used in the calculations under § 85.82. Discontinuation of a vehicle shall be allowed only with the written consent of the Secretary.

(g) (1) The Secretary may elect to operate and test any test vehicle during all or any part of the mileage accumulation and testing procedure. In such cases, the manufacturer shall provide the vehicle(s) to the Secretary with all information necessary to conduct this testing.

(2) The test procedures (§§ 85.71–85.88) will be followed by the Secretary. The Secretary will test the vehicles at each test point. Maintenance may be performed by the manufacturer under such conditions as the Secretary may prescribe.

(3) The data developed by the Secretary for the engine-system combination shall be combined with any applicable data supplied by the manufacturer on other vehicles of that combination to determine the applicable deterioration factors for the combination. In the case of a significant discrepancy between data developed by the Secretary and that submitted by the manufacturer, the Secretary's data shall be used in the determination of deterioration factors.

§ 85.87 Compliance with emission standards.

(a) The exhaust and fuel evaporative emission standards in the regulations in this part apply to the average lifetime emissions of vehicles in public use. Prior to certification, lifetime emissions, are obtained by projection of test data to lifetime normal service. Normal service in an urban area or its equivalent for 100,000 miles is taken as the basis for lifetime emissions.

(b) It is expected that emission control efficiency will change with mileage accumulation on the vehicle. It is assumed that the emission level of a vehicle which has accumulated 50,000 miles in normal service is the average emission level of that vehicle over its lifetime.

(c) The procedure for determining compliance of a new light-duty motor vehicle with exhaust and fuel evaporative emission standards is as follows:

(1) Separate emission deterioration factors shall be determined from the emission results of the durability data vehicles for each engine-system combination. A separate factor shall be established for the combination for exhaust HC, exhaust CO, and fuel evaporative HC.

(i) The applicable results to be used in determining the deterioration factors for each combination shall be:

(a) All emission data from the tests required under § 85.81(b), except the zero mile tests. This shall include the official test results, as determined in § 85.84, for all tests conducted on all durability vehicles of the combination selected under § 85.80(c) (including all vehicles elected to be operated by the manufacturer under § 85.80(c)(3)). Where the Secretary has agreed to a mileage less than 50,000 miles in accordance with § 85.81(b), the data for mileages greater than that actually run will be determined by extrapolating the test data generated at lower mileages.

(b) All emission data from the tests conducted before and after the maintenance provided in § 85.80(g)(1)(ii).

(ii) All applicable results shall be plotted as a function of the mileage on the system, rounded to the nearest mile, and the best fit straight lines, fitted by the method of least squares, shall be drawn through these data points. The interpolated 4,000- and 50,000-mile points on this line must be within the standards provided in §§ 85.21 and 85.22 or the data will not be acceptable for use in calculation of a deterioration factor.

(iii) An exhaust emission deterioration factor shall be calculated for each combination as follows:

$$\text{factor} = \frac{\text{exhaust emissions interpolated to 50,000 miles}}{\text{exhaust emissions interpolated to 4,000 miles}}$$

(iv) An evaporative emission deterioration factor shall be calculated for each combination by subtracting the evaporative emissions interpolated to 4,000 miles from the evaporative emissions interpolated to 50,000 miles.

(2) (i) The exhaust emission test results for each emission data vehicle shall be multiplied by the appropriate deterioration factor: *Provided*, That if a deterioration factor as computed in subparagraph (1)(iii) of this paragraph is less than one, that deterioration factor shall be one for the purposes of this subparagraph.

(ii) The evaporative emission test results for each combination shall be adjusted by addition of the appropriate deterioration factor: *Provided*, That if a deterioration factor as computed in subparagraph (1)(iv) of this paragraph is less than zero, that deterioration factor shall be zero for the purposes of this subparagraph.

(3) The emissions to compare with the standard shall be the adjusted emissions of subparagraph (2) (i) and (ii) of this paragraph for each emission data vehicle.

(4) Every test vehicle of an engine family must comply with all applicable standards, as determined in subparagraph (3) of this paragraph, before any vehicle in that family may be certified.

Subpart I—Test Procedures for Engine Exhaust Emissions (Gasoline Fueled Heavy Duty Engines)

§ 85.100 Introduction.

The procedures described in this subpart will be the test program to determine the conformity of new gasoline fueled heavy duty engines with the applicable standards set forth in this part.

(a) The test consists of prescribed sequences of engine operating conditions to be conducted on an engine dynamometer. The exhaust gases generated during engine operation are sampled continuously for specific component analysis through the analytical train. The tests are applicable to engines equipped with catalytic or direct-flame afterburners, induction system modifications, or other systems, or to uncontrolled engines, designed to determine hydrocarbon and carbon monoxide concentrations during a truck driving pattern in a metropolitan area as simulated on an engine dynamometer. The test consists of two warmup cycles and two hot cycles. The average concentrations for the warmup cycles and the hot cycles are combined to yield the reported values.

(b) When an engine is tested for exhaust emissions or is operated for durability testing on an engine dynamometer the complete engine shall be used with all accessories which might reasonably be expected to influence emissions to the atmosphere installed and functioning.

§ 85.101 Gasoline fuel specification.

(a) For exhaust emission testing, fuel having specifications as shown in the table in § 85.71(a), or substantially equivalent specifications approved by the Secretary, shall be used.

(b) For durability testing, fuel having specifications as shown in the table in § 85.71(b), or substantially equivalent specifications approved by the Secretary, shall be used. The octane rating of the fuel used shall be in the range recommended by the engine manufacturer. The specifications of the fuel to be used shall be reported in accordance with § 85.61(b)(3).

§ 85.102 Dynamometer operation cycle and equipment.

(a) (1) The following nine-mode cycle shall be followed in dynamometer operation tests of gasoline fueled heavy duty engines.

Sequence No.	Mode	Manifold vacuum	Time in mode secs.	Cumulative time secs.	Weighting factor
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

(3) The engine dynamometer shall be operated at a constant speed of 2,000 r.p.m.±100 r.p.m. (exception: representative engine speed for a given displacement engine as determined by its application, but not less than 1,800 r.p.m. nor greater than 2,400 r.p.m.).

(4) The idle operating mode shall be carried out at the manufacturer's recommended engine speed. The CT operating mode shall be carried out at the same engine speed as in subparagraph (3) of this paragraph.

(b) The following equipment shall be used for dynamometer tests.

(1) An engine dynamometer capable of maintaining constant speed±100 r.p.m. from full throttle to closed throttle motoring.

(2) A chassis-type exhaust system or substantially equivalent exhaust system, shall be used.

(3) A radiator typical of that used with the engine in a vehicle, or other means of engine cooling which will maintain the engine operating temperatures at approximately the same temperature as would the radiator, shall be used. An auxiliary fixed speed fan may be used to maintain engine cooling during sustained operation on the dynamometer.

§ 85.103 Dynamometer procedures.

An initial 5-minute idle, two warmup cycles, and two hot cycles constitute a complete dynamometer run. Idle modes may be run at the beginning and end of each test, thus eliminating the need to change speed between cycles. One idle mode preceding the first cycle and one following the fourth cycle is sufficient. The results of the first idle shall be used for calculation of the second cycle emissions and the fourth idle results shall be used for calculation of the third cycle emissions.

§ 85.104 Sampling and analytical system for measuring exhaust emissions.

(a) *Schematic drawing.* The following (fig. 6) is a schematic drawing of the exhaust gas sampling and analytical system which shall be used for testing under the regulations in this subpart.

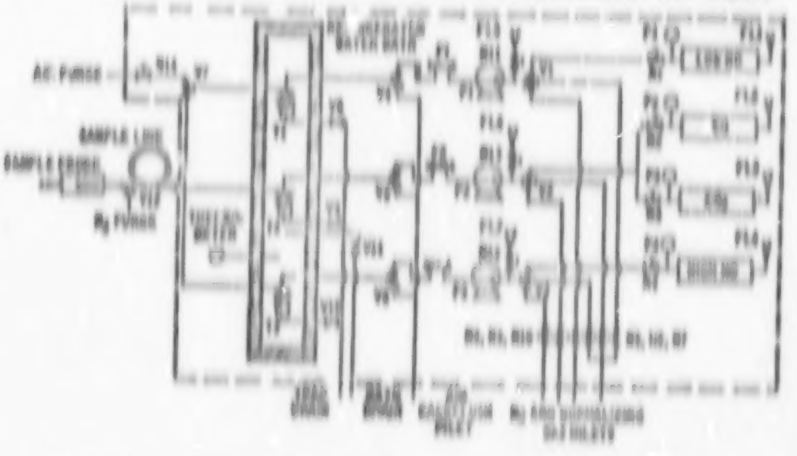


Figure 6: Flow schematic of exhaust gas analysis system employed in Federal facilities.

(b) *Equipment description.* The following components shall be used in sampling and analytical systems for testing under the regulations in this part.

(1) Flowmeters F11, F12, F13 and F14 indicate the sample flow rate through the analyzers.

(2) Low range hydrocarbon analyzer.

(3) Carbon monoxide analyzer.

(4) Carbon dioxide analyzer.

(5) High range hydrocarbon analyzer.

(6) Pressure gauges P1, P2, and P3 indicate the analyzer sample pressure.

(7) Needle valves N1, N2, N3, and N4 regulate sample flow rate to the analyzers.

(8) Needle valves N5, N6, N7, N8, N9, and N10 regulate the flow rates of N_2 and normalizing gases to the analyzers.

(9) Ball valves V1, V2, and V3 for directing either sample or calibration gases to the analyzers.

(10) Needle valves N11, N12, and N13 regulate the sample flow rate through the bypass network.

(11) Flowmeters F15, F16, and F17 indicate the flow rate through the bypass system.

(12) Pumps P1, P2, and P3 for pulling sample from source.

(13) Filters F1, F2, and F3 remove contaminants from sample prior to analysis.

(14) Ball valves V4, V5, and V6 for directing sample to the analyzer or directing air in the reverse direction as a backflush.

(15) Toggle valves V8, V9, V10, and V11 for draining condensate traps and refrigerated bath.

(16) Traps T1, T2, and T3 for condensing water vapor and cooling exhaust sample.

(17) Ball valve V7 for diverting air to low HC analyzer during periods of high hydrocarbon response.

(18) Needle valve N14 for regulating air flow to low hydrocarbon analyzer during purge conditions.

(19) Thermometer for indicating bath temperature.

(20) Refrigerated water bath for condensing water vapor and cooling exhaust sample.

(21) Sample line from vehicle to analysis system.

(22) Sample probe to extract exhaust gas sample downstream of muffler.

(23) Ball valve V12 for diverting N_2 to hydrocarbon analyzers.

(c) *Hang up reduction.* Stringent methods to reduce hang up may be employed. All methods must be approved in advance by the Secretary.

§ 85.105 Information to be recorded on charts.

The following information shall be recorded with respect to each test:

(a) Test number.

(b) System tested (brief description).

(c) Date and time of day for each part of the test schedule.

(d) Instrument Operator.

(e) Driver or Operator.

(f) Engine Make—identification number—date of manufacture—number of hours—engine displacement—engine family—idle r.p.m.—number carburetors—number of carburetor venturis.

(g) All pertinent instrument information such as tuning—gain—serial numbers—detector numbers—range.

(h) Recorder Charts: Identify zero, span, exhaust gas sample traces.

(i) Barometric pressure, intake air temperature and humidity and, as applicable, the temperature of the air in front of the radiator during the test.

(j) A continuous trace of intake manifold vacuum and engine r.p.m. recorded on the same chart with an automatic marker indicating one second intervals.

§ 85.106 Calibration and instrument checks.

(a) The instrument assembly shall be calibrated at least once every 30 days, using the same flow rate as when sampling exhaust and proceeding as follows:

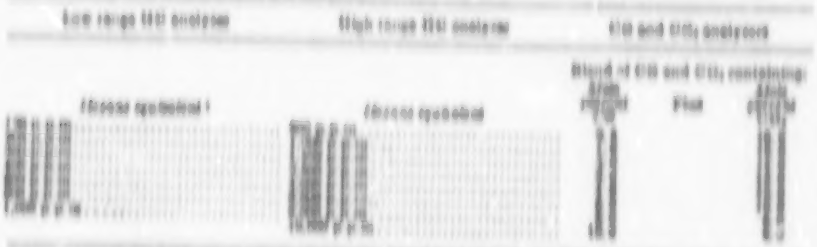
(1) Tune analyzers.

(2) Zero on nitrogen: Check each cylinder of N_2 for contamination with hy-

directions. Set the instrument gain to give the desired range. Normal operating ranges are as follows:

Low-Range Hydrocarbon Analyzer.	0-1,000 p.p.m. hexane equivalent.
High-Range Hydrocarbon Analyzer.	0-10,000 p.p.m. hexane equivalent.
CO Analyzer	0-10% CO.
CO_2 Analyzer	0-15% CO_2.

(3) Calibrate with the following normalizing gases. Flow rates should be set at [illegible] c.f.h. on the hydrocarbon analyzers and 5 c.f.h. on the carbon monoxide and carbon dioxide analyzers. The concentrations given indicate nominal concentrations, and actual concentrations should be known to within ±2 percent of true value. Prepurified N_2 is used as the diluent.


Low range HC analyzer
High range HC analyzer
CO and CO_2 analyzers
(Hexane equivalent)¹
(Hexane equivalent)
Blend of CO and CO_2 containing:
Plus

Minimum storage temperature of the cylinders shall be 40° F.; minimum use temperature shall be 60° F.

(4) Compare values with previous curves. Any significant change reflects some problem in the system. Locate and correct problem, and recalibrate. Use best judgment in selecting curve for data reduction.

(5) Check response of hydrocarbon analyzer to 100 percent CO_2. If response is greater than 0.5 percent full scale, refill filter cells with 100 percent CO_2 and recheck. Note any remaining response on chart. If response still exceeds 0.5 percent, replace detector.

(6) Check response of hydrocarbon analyzers to nitrogen saturated with water at ambient temperature. Record ambient temperature. If the low-range instrument response exceeds 1 percent of full scale with saturated nitrogen at 75° F., replace the detector. If the high-range response exceeds 0.5 percent of full scale, check detector on low-range instrument, then reject if response exceeds 5 percent of full scale at 75° F.

(b) The following daily instrument check shall be performed, allowing a minimum of 2 hours warmup for infrared analyzers. (Power is normally left on continuously; but, when instruments are not in use, chopper motor is turned off.):

(1) Zero on clean nitrogen introduced at analyzer inlet. Obtain a stable zero on the amplifier meter and recorder. Recheck after test.

(2) Introduce normalizing gas and set gain to match calibration curve. In order to avoid a correction for sample cell pressure, normalize and calibrate at the same flow rates used for exhaust sampling. Normalizing or span gases: (See paragraph (a)(3) of this section for allowable variation.)

Low-Range Hydrocarbon Analyzer.	1,000 p.p.m. hexane equivalent in prepurified N_2.
High-Range Hydrocarbon Analyzer.	10,000 p.p.m. hexane equivalent in prepurified N_2.
CO Analyzer	10% CO in prepurified N_2.
CO_2 Analyzer	10 to 15% CO_2 in prepurified N_2.

If gain has shifted significantly, check tuning. If necessary, check calibration. Recheck after test. Record actual concentrations on chart.

(3) Check nitrogen zero; repeat the procedure in subparagraphs (1) and (2) of this paragraph if required.

(4) Check flow rates and pressures.

§ 85.107 Dynamometer test run.

(a) The engine shall be allowed to stand with engine turned off for at least 1 hour before the exhaust emission test at an ambient temperature of 68° F. to 86° F. The engine shall be stored prior to the emission tests in such a manner that it is not exposed to precipitation or condensation. During the dynamometer run, the ambient temperature shall be between 68° F. and 86° F.

(b) The following steps shall be taken for each test:

(1) Mount test engine on the engine dynamometer.

(2) Calibrate exhaust emission analyzer assembly.

(3) Start cooling system, if it is to be used.

(4) Start engine and idle at 1,000-1,200 r.p.m. for 5 minutes.

(5) Obtain normal idle speed, record it, and start exhaust sampling.

(6) Run four 9-mode cycles.

(7) Upon completion of the test, purge the sample line with nitrogen to establish a constant hydrocarbon "hangup" level. The hydrocarbon concentration shall drop to 2 percent of scale in 10 seconds and 1 percent of scale in 1 minute, or the test is invalid. [illegible] of exhaust emission instruments. A drift in excess of 2.0 percent of scale in the calibration of any one of the exhaust emission analyzers will invalidate the test results.

§ 85.108 Chart reading.

The recorder response for measuring exhaust gas concentrations always lags the engine's operation because of a variable exhaust system delay and a fixed sample system delay. Therefore, the concentrations for each mode will not be located on the chart at a point corresponding to the exact time of the mode. For each warmup or hot cycle to be evaluated, proceed as follows:

(a) Determine whether the cycle was run in accordance with the specified cycle timing by observing either chart pips, speed trace, manifold vacuum trace, or concentration traces. Deviation by more than 2 seconds from the specified time for the closed throttle mode (sequence 6) or deviation of more than 0.5" Hg from the specified mode vacuums during the last 10 seconds of a mode will invalidate the data.

(b) Time correlate the hydrocarbon, carbon monoxide, and carbon dioxide charts. Determine the location on the chart of concentrations corresponding to each mode. Determine and compensate for trace abnormalities.

(c) For all open throttle (3", 10", 16", and 19" Hg) and idle modes, integrate the last 5 seconds of the HC, CO and CO_2 traces.

(d) The values recorded for the initial idle mode are used for both warmup cycles 1 and 2. The final idle mode values are applied to hot cycles 3 and 4.

(e) Integrate the complete HC, CO, and CO_2 traces during this 40-second closed throttle mode of each cycle.

(f) Direct computer analysis of analyzer output may be utilized provided that the analysis is sufficiently similar to the above procedures to result in comparable data results.

§ 85.109 Calculations.

The final reported test results shall be derived through the following steps:

(a) Determine composite hydrocarbon and carbon monoxide concentrations for the first and second cycles. Average the results of these two cycles.

(b) Determine composite hydrocarbon and carbon monoxide concentrations for the third and fourth cycles. Average the results of these two cycles.

(c) Combine the results of paragraphs (a) and (b) of this section according to the formula: 0.35(a) plus 0.65(b). As the hydrocarbon, carbon monoxide, and carbon dioxide are all measured with essentially the same moisture content, no moisture correction is required to convert the results to a dry basis. The correction factor:

$$\frac{14.5}{\% CO_2 + (0.5)(\% CO) + (6)(\% HC)}$$

shall be applied to the measured concentrations of hydrocarbon and carbon monoxide to correct those observed values for dilution of the exhaust.

§ 85.110 Test engines.

(a) The engines covered by the application for certification will be divided into engine families based upon the criteria outlined in § 85.6(a).

(b) Emission data engines:

(1) Engines will be chosen to be run for emission data based upon the engine family groupings. Within each engine

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¹ The [illegible] of propane, when used as the normalizing gas for calibrating nondispersive infrared analyzers, is [illegible]

family, the requirements of this paragraph must be met.

(2) Engines of each engine family will be divided into engine displacement-exhaust emission control system combinations. A projected sales volume will be established for each combination for the model year for which certification is sought. One engine of each combination will be selected in order of decreasing projected sales volume until 70 percent of the projected sales of a manufacturer's total production of engines of that family is represented, or until a maximum of four engines is selected. The engines selected for each combination will be specified by the Secretary as to fuel system.

(3) The Secretary may select a maximum of two additional engines within each engine family based upon features indicating that they may have the highest emission levels of the engines in that engine family. In selecting these engines, the Secretary will consider such features as the exhaust emission control system, induction system characteristics, ignition system characteristics, fuel system, rated horsepower, rated torque, and compression ratio.

(4) If the engines selected in accordance with subparagraphs (2) and (3) of this paragraph do not represent each engine-system combination, then one engine of each engine-system combination not represented shall be selected by the Secretary. The engine selected shall be of the displacement with the largest projected sales volume of engines with the exhaust emission control system in the family and will be designated by the Secretary as to fuel system.

(c) Durability data engines:

(1) A durability data engine will be selected by the Secretary to represent each engine-system combination. The engine selected shall be of the displacement with the largest projected sales volume of engines with that exhaust emission control system in that engine family and will be designated by the Secretary as to fuel system.

(2) If an exhaust emission control system is used in only one engine family, an additional engine using that control system in that family will be selected so that the durability data fleet shall contain at least two engines with each control system. The additional engine will be selected in the same manner as engines selected under subparagraph (1) of this paragraph.

(3) A manufacturer may elect to operate and test additional engines to represent any engine-system combination. The additional engines must be of the same engine displacement and fuel system as the engine selected for that combination in accordance with the provisions of subparagraph (1) of this paragraph. Notice of an intent to test additional engines shall be given to the Secretary not later than 30 days following notification of the test fleet selection.

(d) Any manufacturer whose projected sales of new motor vehicle engines subject to this subpart for the model year for which certification is sought is less than 700 engines may request a reduction in the number of test engines determined in accordance with the foregoing provisions of this section. The Secretary may agree to such lesser number as he determines will meet the objectives of this procedure.

(e) In lieu of testing an emission data or durability data vehicle selected under paragraph (b) or (c) of this section and submitting data therefor, a manufacturer may, with the prior written approval of the Secretary, submit data on a similar vehicle for which certification has previously been obtained.

§ 85.111 Maintenance.

(a) (1) Maintenance on the engines and fuel systems of durability engines may be performed only under the following provisions:

(i) Two major engine tuneups to manufacturer's specifications may be performed at 500 and 1,000 hours (±6 hours) of scheduled dynamometer operation with the following exception: On engines with a displacement of 300 cubic inches or less, a major engine tuneup may be performed at 375, 750, and 1,125 hours (±6 hours) of scheduled dynamometer operation. A major engine tuneup shall be restricted to the following:

(a) Replace spark plugs.

(b) Inspect ignition wiring and replace as required.

(c) Replace distributor breaker points and condenser as required.

(d) Lubricate distributor cam.

(e) Check distributor advance and breaker point dwell angle and adjust as required.

(f) Check automatic choke for free operation and correct as required.

(g) Adjust carburetor idle speed and mixture.

(h) Adjust drive belt tension on engine accessories.

(i) Adjust valve lash if required.

(j) Check exhaust heat control valve for free operation.

(k) Check engine bolt torque and tighten as required.

(ii) Spark plugs may be changed if a persistent misfire is detected.

(iii) Normal service (engine oil change and oil filter, fuel filter and air filter servicing) will be allowed at manufacturer's recommended intervals.

(iv) The crankcase emission control system may be serviced at 375-hour intervals (±6 hours) of dynamometer operation.

(v) Readjustment of the engine choke mechanism or idle setting may be performed only if there is a problem of stalling at idle.

(vi) Leaks in the fuel system, engine lubrication system and cooling system may be repaired.

(vii) Any other engine or fuel system maintenance or repairs will be allowed only with the advance approval of the Secretary.

(2) Allowable maintenance on emission data engines shall be limited to the adjustment of engine idle speed at the 125 hour test point.

(b) Complete emission tests (§§ 85.101–85.108) shall be run before and after any engine maintenance which may reasonably be expected to affect emissions. These test data shall be supplied to the Secretary immediately after the tests, along with a complete record of all pertinent maintenance, including an engineering report of any malfunction diagnosis and the corrective action taken. In addition, all test data and maintenance reports shall be compiled and provided to the Secretary in accordance with § 85.63.

(c) If the Secretary determines that maintenance or repairs have resulted in a substantial change to the engine-system combination, the engine shall not be used as a durability data engine.

§ 85.112 Service accumulation and emission measurements.

The engine dynamometer service accumulation schedule will consist of several operating conditions which give the same percentage of time at various manifold vacuums and the modes as specified in the emission test cycle. The average speed shall be between 1,800 and 2,700 r.p.m. with some operation at 3,600 r.p.m. or governed speed, whichever is lower. Maximum cycle time shall be 15 minutes. A cycle approved in advance by the Secretary shall be used.

(a) Emission data engines: Each emission data engine shall be operated for 125 hours with all emission control systems installed and operating. Emission tests shall be conducted at zero and 125 hours.

(b) Durability data engines: Each durability data engine shall be operated, with all emission control systems installed and operating, for 1,500 hours. Emission measurements, as prescribed, shall be made at zero hours and at each 125-hour interval.

(c) All tests required by this subpart to be conducted after 125 hours of operation or at any multiple of 125 hours may be conducted at any accumulated number of hours within 6 hours of 125 hours or the appropriate multiple of 125 hours, respectively.

(d) The results of each emission test shall be supplied to the Secretary immediately after the test. In addition, all test data shall be compiled and provided to the Secretary in accordance with § 85.63.

(e) Whenever the manufacturer proposes to operate and test an engine which may be used for emission or durability data, he shall provide the zero hour test data to the Secretary and make the engine available for such testing under § 85.64 as the Secretary may require, before beginning to accumulate hours on the engine. Failure to comply with this requirement will invalidate all test data later submitted for this engine.

(f) Once a manufacturer begins to operate an emission data or durability data engine, as indicated by compliance with paragraph (e) of this section, he shall continue to run the engine to 125 hours or 1,500 hours, respectively, and the data from the engine will be used in the calculations under § 85.113. Discontinuation of an engine shall be allowed only with the prior written consent of the Secretary.

[illegible]

APPENDIX D

RESULTS OF SURVEILLANCE TEST BY INSPECTION ROUND

TABLE D-1. VEHICLE DESCRIPTION AND FIRST ROUND EMISSION RESULTS—"ZERO MONTHS" HEAVY DUTY GASOLINE SURVEILLANCE (as of July 6, 1971)

TABLE D-1. VEHICLE DESCRIPTION AND FIRST ROUND EMISSION RESULTS—"ZERO MONTHS" HEAVY-DUTY GASOLINE SURVEILLANCE (Cont'd) (as of July 6, 1971)

TABLE D-1. VEHICLE DESCRIPTION AND FIRST ROUND EMISSION RESULTS--"ZERO MONTHS" HEAVY-DUTY GASOLINE SURVEILLANCE (Cont'd) (as of July 6, 1971)

[illegible]

TABLE D-2. VEHICLE DESCRIPTION AND SECOND ROUND EMISSION RESULTS—"FOUR MONTHS" HEAVY DUTY GASOLINE SURVEILLANCE (as of November 1, 1971)

[illegible]

TABLE D-2. VEHICLE DESCRIPTION AND SECOND ROUND EMISSION RESULTS—"FOUR MONTHS" HEAVY-DUTY GASOLINE SURVEILLANCE (Cont'd) (as of November 1, 1971)

Unit No.	Date Tested	Truck No.	Source	Vehicle Year	Make	Engine CID	Cyl.	Trans Speeds*	GVW lbs.	Vehicle Type	Test Miles	HC ppm	CO %	NOx ppm Unc.	NOx ppm Corr.	Unit No.
51	[illegible]	[illegible]	Pearl	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Delivery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	51
52	[illegible]	[illegible]	Pearl	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Delivery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	52
53	[illegible]	[illegible]	Pearl	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Delivery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	53
54	[illegible]	[illegible]	Pearl	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Delivery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	54
55	[illegible]	[illegible]	C.W.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Crew Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	55
56	[illegible]	[illegible]	C.W.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	56
57	[illegible]	[illegible]	C.W.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57
58	[illegible]	[illegible]	C.W.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	58
59	[illegible]	[illegible]	C.W.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	59
60	[illegible]	[illegible]	C.W.B.	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60
61	[illegible]	[illegible]	C.W.B.	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	61
62	[illegible]	[illegible]	C.W.B.	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Crane	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	62
63	[illegible]	[illegible]	C.W.B.	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Crane	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	63
64	[illegible]	[illegible]	Red Arrow	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	64
65	[illegible]	[illegible]	Red Arrow	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	65
66	[illegible]	[illegible]	C.W.B.	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Meter	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	66
67	[illegible]	[illegible]	C.W.B.	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	67
68	[illegible]	[illegible]	C.W.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Dump	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	68
69	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Line	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	69
70	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Line	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	70
71	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Digger	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	71
72	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Digger	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	72
73	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Line	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	73
74	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Line	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	74
75	[illegible]	[illegible]	State Hwy	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Pickup	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75
76	[illegible]	[illegible]	State Hwy	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Pickup	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	76
77	[illegible]	[illegible]	State Hwy	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Pickup	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	77
78	[illegible]	[illegible]	State Hwy	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Van	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	78
79	[illegible]	[illegible]	State Hwy	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Bus	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	79
80	[illegible]	[illegible]	Lone Star	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Delivery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	80
81	[illegible]	[illegible]	Herder	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	81
82	[illegible]	[illegible]	Herder	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	82
83	[illegible]	[illegible]	Herder	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	83
84	[illegible]	[illegible]	Herder	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	84
85		[illegible]	C.W.B.	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Service	Wrecked					85
86	[illegible]	[illegible]	State Hwy	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Laundry	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	86
87	[illegible]	[illegible]	State Hwy	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Grounds	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	87
88	[illegible]	[illegible]	State Hwy	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	88
89	[illegible]	[illegible]	State Hwy	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	89
90	[illegible]	[illegible]	State Hwy	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Grounds	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	90
91	[illegible]	[illegible]	City P&R	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Water Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	91
92	[illegible]	[illegible]	City P&R	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	92
93	[illegible]	[illegible]	[illegible]	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Repair	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	93
94	[illegible]	[illegible]	City P&R	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	94
95	[illegible]	[illegible]	City P&R	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	95
96	[illegible]	[illegible]	B.C.R.D.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	96
97	[illegible]	[illegible]	B.C.R.D.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	97
98	[illegible]	[illegible]	B.C.R.D.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Water Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	98
99	[illegible]	[illegible]	B.C.R.D.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Water Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99
100	[illegible]	[illegible]	B.C.R.D.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Water Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100

*[illegible]

TABLE D-2. VEHICLE DESCRIPTION AND SECOND ROUND EMISSION RESULTS—"FOUR MONTHS" HEAVY DUTY GASOLINE SURVEILLANCE (Cont'd) (as of November 1, 1971)

Car No.	Date Tested	Truck No.	Source	Vehicle Year	Make	Engine CID	Cyl.	Trans. Speeds	GVW lbs	Vehicle Type	Test Miles	Emission Results				Car No.
												HC ppm	CO %	NO ppm		
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TABLE D-3. Vehicle Description and Third Round Emission Results – Eight Months
Heavy Duty Gasoline Surveillance
(as of February 1, 1972)

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	P.O.D.	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Van	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1
2	[illegible]	[illegible]	P.O.D.	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Van	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
3	[illegible]	[illegible]	P.O.D.	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Van	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3
4	[illegible]	[illegible]	P.O.D.	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Van	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4
5	[illegible]	[illegible]	P.O.D.	[illegible]	Dodge	[illegible]	[illegible]	[illegible]	[illegible]	Van	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5
6	[illegible]	[illegible]	ABC	[illegible]	White	[illegible]	[illegible]	[illegible]	[illegible]	Tractor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6
7	[illegible]	[illegible]	ABC	[illegible]	White	[illegible]	[illegible]	[illegible]	[illegible]	Tractor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7
8	[illegible]	[illegible]	ABC	[illegible]	White	[illegible]	[illegible]	[illegible]	[illegible]	Tractor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8
9	[illegible]	[illegible]	ABC	[illegible]	White	[illegible]	[illegible]	[illegible]	[illegible]	Tractor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9
10	[illegible]	[illegible]	ABC	[illegible]	White	[illegible]	[illegible]	[illegible]	[illegible]	Tractor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10
11	[illegible]	[illegible]	Ryder	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Tractor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11
12	[illegible]	[illegible]	Ryder	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Tractor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12
13	[illegible]	[illegible]	Ryder	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Tractor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	13
14	[illegible]	[illegible]	Ryder	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Tractor	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14
15	[illegible]	[illegible]	N.S.S.D.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	School Bus	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15
16	[illegible]	[illegible]	N.S.S.D.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	School Bus	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	16
17	[illegible]	[illegible]	N.S.S.D.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	School Bus	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	17
18	[illegible]	[illegible]	N.S.S.D.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	School Bus	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18
19	[illegible]	[illegible]	N.S.S.D.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	School Bus	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	19
20	[illegible]	[illegible]	Hertz	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Stake	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20
21	[illegible]	[illegible]	Hertz	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Pick-up	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21
22	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	22
23	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23
24	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24
25	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	25
26	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Van	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	26
27	[illegible]	[illegible]	C.P.S.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	27
28	[illegible]	[illegible]	C.P.S.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	28
29	[illegible]	[illegible]	C.P.S.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29
30	[illegible]	[illegible]	C.P.S.B.	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30
31	[illegible]	[illegible]	C.P.S.B.	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	31
32	[illegible]	[illegible]	C.P.S.B.	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	32
33	[illegible]	[illegible]	Brown Exp.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Freight	Transferred to another city					33
34	[illegible]	[illegible]	Brown Exp.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Freight	–	–	–	–		34
35	[illegible]	[illegible]	Brown Exp.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Freight						35
36	[illegible]	[illegible]	C.P.S.B.	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	36
37	[illegible]	[illegible]	C.P.S.B.	[illegible]	Chevrolet	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	37
38	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	38
39	[illegible]	[illegible]	C.P.S.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	39
40	[illegible]	[illegible]	C.P.S.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	40
41	[illegible]	[illegible]	C.P.S.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	41
42	[illegible]	[illegible]	C.P.S.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Wrecker	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	42
43	[illegible]	[illegible]	C.P.S.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	43
44	[illegible]	[illegible]	C.P.S.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Stake	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	44
45	[illegible]	[illegible]	C.P.S.B.	[illegible]	Ford	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	45
46	[illegible]	[illegible]	C.P.S.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Bucket Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	46
47	[illegible]	[illegible]	C.W.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	47
48	[illegible]	[illegible]	C.W.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	48
49	[illegible]	[illegible]	C.W.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Crew Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	49
50	[illegible]	[illegible]	C.W.B.	[illegible]	GMC	[illegible]	[illegible]	[illegible]	[illegible]	Crew Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	50

TABLE D-3. (cont'd) Vehicle Description and Third Round Emission Results "Eight Months" Heavy Duty Gasoline Surveillance (as of February 1, 1972)

Test No.	Date Tested	Truck No.	Owner	Vehicle Year	Make	Engine CID	Cyl.	Trans. Speeds*	GVW lbs.	Vehicle Type	Test Miles	Emission Results HC, ppm	Emission Results CO, %	Emission Results NO, ppm Dia.	Emission Results NO, ppm Corr.	Test No.
51	[illegible]	[illegible]	Pearl	1970	IHC	[illegible]	V8	3	7,500	Delivery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	51
52	[illegible]	[illegible]	Pearl	1970	GMC	[illegible]	6	3	7,500	Delivery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	52
53	[illegible]	[illegible]	Pearl	1970	Dodge	318	V8	3	7,500	Delivery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	53
54	[illegible]	[illegible]	Pearl	1970	Ford	300	6	3	7,500	Delivery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	54
55	[illegible]	[illegible]	C.W.B.	1970	IHC	304	V8	4	19,700	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	55
56	[illegible]	[illegible]	C.W.B.	1970	IHC	304	V8	4	19,700	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	56
57	[illegible]	[illegible]	C.W.B.	1970	IHC	304	V8	4	19,700	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57
58	[illegible]	[illegible]	C.W.B.	1970	IHC	304	V8	4	19,700	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	58
59	[illegible]	[illegible]	C.W.B.	1970	IHC	304	V8	4	19,700	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	59
60	[illegible]	[illegible]	C.W.B.	1970	Chevrolet	[illegible]	V8	4	7,500	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	60
61	[illegible]	[illegible]	C.W.B.	1970	Chevrolet	[illegible]	V8	4	7,500	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	61
62	[illegible]	[illegible]	C.W.B.	1970	Chevrolet	[illegible]	V8	5	32,000	Crane	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	62
63	[illegible]	[illegible]	C.W.B.	1970	Chevrolet	[illegible]	V8	5	32,000	Crane	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	63
64	[illegible]	[illegible]	Red Arrow	1970	Dodge	318	V8	4	24,000	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	64
65	[illegible]	[illegible]	Red Arrow	1970	Dodge	318	V8	4	24,000	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	65
66	[illegible]	[illegible]	C.W.B.	1970	Dodge	318	V8	3 auto	7,500	Water	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	66
67	[illegible]	[illegible]	C.W.B.	1970	Dodge	318	V8	3 auto	7,500	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	67
68	[illegible]	[illegible]	C.W.B.	1970	Ford	361	V8	5	25,500	Dump	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	68
69	[illegible]	[illegible]	C.P.S.B.	1970	IHC	392	V8	4 auto	25,500	Line	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	69
70	[illegible]	[illegible]	C.P.S.B.	1970	IHC	392	V8	4 auto	25,500	Line	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	70
71	[illegible]	[illegible]	C.P.S.B.	1971	IHC	[illegible]	V8	5	25,000	Digger	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	71
72	[illegible]	[illegible]	C.P.S.B.	1971	IHC	[illegible]	V8	5	25,000	Digger	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	72
73	[illegible]	[illegible]	C.P.S.B.	1970	IHC	392	V8	4 auto	25,500	Line	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	73
74	[illegible]	[illegible]	C.P.S.B.	1970	IHC	392	V8	4 auto	25,500	Line	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	74
75	[illegible]	[illegible]	State Hosp.	1970	Dodge	225	6	4	7,500	Pickup	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	75
76	[illegible]	[illegible]	State Hosp.	1970	Dodge	225	6	4	[illegible]	Pickup	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	76
77	[illegible]	[illegible]	State Hosp.	1970	Dodge	225	6	4	7,500	Pickup	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	77
78	[illegible]	[illegible]	State Hosp.	1970	Ford	302	V8	3 auto	6,000	Van	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	78
79	[illegible]	[illegible]	State Hosp.	1970	GMC	401	V8	5	27,000	Bus	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	79
80	[illegible]	[illegible]	Lone Star	1970	Chevrolet	[illegible]	V8	4	6,000	Delivery	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	80
81	[illegible]	[illegible]	Herder	1970	Ford	300	6	5	21,000	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	81
82	[illegible]	[illegible]	Herder	1970	Ford	300	6	5	21,000	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	82
83	[illegible]	[illegible]	Herder	1970	Ford	361	V8	5	22,000	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	83
84	[illegible]	[illegible]	Herder	1970	Ford	[illegible]	V8	5	22,000	Freight	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	84
85	[illegible]	[illegible]	C.W.B.	1970	Chevrolet	[illegible]	V8	2 auto	7,500	Service	This truck was wrecked May [illegible], 1971					85
86	[illegible]	[illegible]	State Hosp.	1970	Dodge	225	6	3 auto	10,000	Laundry	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	86
87	[illegible]	[illegible]	State Hosp.	1970	Dodge	225	6	3 auto	10,000	Grounds	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	87
88	[illegible]	[illegible]	State Hosp.	1970	Dodge	225	6	3 auto	7,500	Service	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	88
89	[illegible]	[illegible]	State Hosp.	1970	Dodge	225	6	3 auto	10,000	Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	89
90	[illegible]	[illegible]	State Hosp.	1970	Dodge	225	6	3 auto	[illegible]	Grounds	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	90
91	[illegible]	[illegible]	City P&R	1970	IHC	[illegible]	V8	4	19,000	Water Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	91
92	[illegible]	[illegible]	City P&R	1970	Ford	360	V8	4	8,500	Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	92
93	[illegible]	[illegible]	[illegible]	1970	Ford	360	V8	4	7,500	Repair	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	93
94	[illegible]	[illegible]	City P&R	1970	Chevrolet	292	6	3 auto	14,000	Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	94
95	[illegible]	[illegible]	City P&R	1970	Ford	360	V8	4	8,500	Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	95
96	[illegible]	[illegible]	B.C.R.D.	1970	Ford	240	6	3	7,500	Maintenance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	96
97	[illegible]	[illegible]	B.C.R.D.	1970	Ford	240	6	3	7,500	Ladder	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	97
98	[illegible]	[illegible]	B.C.R.D.	1970	Ford	330	V8	5	21,000	Water Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	98
99	[illegible]	[illegible]	B.C.R.D.	1970	Ford	330	V8	4	21,000	Water Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	99
100	[illegible]	[illegible]	B.C.R.D.	1970	Ford	330	V8	4	21,000	Water Truck	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	100

*[illegible]

TABLE D-3. (cont'd) Vehicle Description and Third Round Emission Results - "Eight Months"
Heavy Duty Gasoline Surveillance
(as of February 1, 1972)

TABLE D-4. VEHICLE DESCRIPTION AND FOURTH ROUND EMISSION RESULTS--"TWELVE MONTHS" HEAVY DUTY GASOLINE SURVEILLANCE (as of July 1, 1972)

TABLE D-4. VEHICLE DESCRIPTION AND FOURTH ROUND EMISSION RESULTS--"TWELVE MONTHS" HEAVY DUTY GASOLINE SURVEILLANCE (Cont'd) (as of July 1, 1972)

TABLE D-4. VEHICLE DESCRIPTION AND FOURTH ROUND EMISSION RESULTS--"TWELVE MONTHS" HEAVY DUTY GASOLINE SURVEILLANCE (Cont'd) (as of July 1, 1972)

TABLE D-5. ROUND 1 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - HYDROCARBONS

Manufacturer	CID	Cyl.	Number In Group	Mean	Min	Max	Standard Deviation
Chevrolet	427	V8	2	151	63	238	124
White	400	6	5	154	96	189	38
Ford	302	V8	1	164	-	-	-
Ford	300	6	17	172	132	223	26
Chevrolet	366	V8	2	177	170	184	10
GMC	350	V8	2	189	154	223	49
Dodge	225	6	8	206	181	255	25
Chevrolet	292	6	2	209	173	244	50
GMC	292	6	5	217	170	254	41
GMC	401	V6	1	229	-	-	-
Ford	360	V8	5	232	209	260	18
Chevrolet	350	V8	7	241	84	362	94
IHC	392	V8	23	246	148	310	43
Dodge	318	V8	15	247	173	328	43
Chevrolet	307	V8	11	257	158	615	129
Ford	240	6	3	261	261	262	1
Chevrolet	250	6	4	263	249	273	10
Ford	391	V8	4	264	189	317	54
IHC	345	V8	8	273	230	345	37
IHC	478	V8	7	275	229	307	29
Ford	361	V8	3	279	232	322	45
IHC	304	V8	13	297	252	352	37
Ford	330	V8	4	315	253	407	68

TABLE D-6. ROUND 1 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - CARBON MONOXIDE

Manufacturer	CID	Cyl.	Number In Group	Mean	Min	Max	Standard Deviation
Ford	300	6	17	0.57	0.26	0.83	0.16
Ford	240	6	3	1.00	0.45	1.62	0.59
Chevrolet	292	6	2	1.02	0.89	1.15	0.18
Ford	391	V8	4	1.07	0.54	1.70	0.56
Ford	302	V8	1	1.07	-	-	-
Chevrolet	366	V8	2	1.15	1.14	1.16	0.01
Chevrolet	350	V8	7	1.16	0.88	1.71	0.28
IHC	345	V8	8	1.18	0.89	1.57	0.21
IHC	304	V8	13	1.30	0.78	2.24	0.37
GMC	292	6	5	1.37	0.86	2.27	0.55
Chevrolet	250	6	4	1.40	1.19	1.69	0.22
Chevrolet	427	V8	2	1.42	1.32	1.52	0.14
Ford	361	V8	5	1.45	1.18	1.76	0.29
IHC	478	V8	7	1.57	1.10	1.88	0.29
Dodge	225	6	8	1.78	1.57	2.13	0.20
Ford	360	V8	5	1.79	1.20	2.06	0.34
Dodge	318	V8	15	1.96	1.44	2.69	0.38
GMC	401	V6	1	2.04	-	-	-
GMC	350	V8	2	2.05	0.47	3.62	2.23
Ford	330	V8	4	2.10	0.71	5.51	2.28
Chevrolet	307	V8	11	2.33	1.61	3.79	0.67
IHC	392	V8	23	2.28	1.10	4.24	0.60
White	400	6	5	2.45	1.46	4.49	1.18

TABLE D-7. ROUND 1 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - OBSERVED NITRIC OXIDE

Manufacturer	CID	Cyl.	Number In Group	Mean	Min	Max	Standard Deviation
Chevrolet	366	V8	2	682	481	1282	566
Chevrolet	427	V8	2	909	593	1224	466
IHC	392	V8	23	1059	423	2346	396
Chevrolet	350	V8	7	1187	979	1384	186
Dodge	318	V8	15	1457	656	2519	563
GMC	350	V8	2	1575	1311	1839	373
IHC	478	V8	7	1662	1419	2148	254
White	400	6	5	1742	1213	2221	369
GMC	401	V6	1	1760	-	-	-
Ford	360	V8	8	1783	1419	2053	254
Ford	302	V8	1	1798	-	-	-
Ford	361	V8	3	1943	1658	2212	277
Chevrolet	307	V8	11	1962	1102	2655	491
GMC	292	6	8	2059	1140	3241	917
Ford	240	6	3	2086	1853	2356	278
IHC	345	V8	5	2118	1585	2477	295
IHC	304	V8	13	2146	1784	2916	313
Dodge	225	6	8	2162	1651	2452	234
Ford	391	V8	4	2201	1410	3068	696
Chevrolet	292	6	2	2203	2184	2222	27
Ford	300	6	17	2272	1112	3984	690
Chevrolet	250	6	4	2333	2189	2462	111
Ford	330	V8	4	2430	806	3025	1084

TABLE D-8. ROUND 1 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - CORRECTED NITRIC OXIDE

Manufacturer	CID	Cyl.	Number In Group	Mean	Min	Max.	Standard Deviation
Chevrolet	366	V8	2	712	390	1034	454
Chevrolet	427	V8	2	945	600	1293	488
IHC	392	V8	23	1040	378	2276	385
Chevrolet	350	V8	7	1238	1022	1432	159
Dodge	318	V8	15	1306	552	2308	527
GMC	350	V8	2	1568	1302	1834	376
GMC	401	V6	1	1656	-	-	-
White	400	6	5	1683	1316	2387	450
Ford	360	V8	5	1698	1497	1981	181
IHC	478	V8	7	1713	1474	2187	237
Chevrolet	307	V8	11	1767	1150	2384	361
Ford	361	V8	3	1785	1540	2093	282
Ford	302	V8	1	1803	-	-	-
GMC	292	6	5	1856	998	2603	770
Ford	391	V8	4	1925	1340	2424	461
IHC	304	V8	13	1932	1612	2363	226
Dodge	225	6	8	2076	1512	2599	318
Ford	240	6	3	2050	1840	2445	343
Ford	300	6	17	2186	1065	3957	708
IHC	345	V8	8	2168	1671	2572	306
Chevrolet	292	6	2	2238	2193	2284	64
Chevrolet	250	6	4	2358	2228	2455	101
Ford	330	V8	4	2375	801	3182	1098

TABLE D-7. ROUND 2 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - HYDROCARBONS

Manufacturer	CID	Cyl.	Number In Group	Mean	Min	Max	Standard Deviation
Chevrolet	366	V8	2	163	139	186	33
GMC	350	V8	2	203	197	208	8
Ford	300	6	17	204	150	262	31
White	400	6	5	213	174	249	27
Chevrolet	292	6	2	233	208	257	35
Ford	302	V8	1	236	-	-	-
Chevrolet	427	V8	2	239	236	242	4
Ford	391	V8	4	255	202	314	48
Chevrolet	307	V8	11	255	192	369	40
IHC	345	V8	8	260	190	282	30
GMC	292	6	5	262	198	317	47
Dodge	225	6	8	262	230	319	29
IHC	478	V8	7	264	182	399	67
IHC	304	V8	13	267	206	325	36
Chevrolet	350	V8	7	274	196	420	85
IHC	392	V8	23	280	187	375	45
Chevrolet	250	6	4	281	260	294	15
Dodge	318	V8	15	282	207	341	42
Ford	360	V8	5	290	274	304	12
Ford	240	6	3	311	261	344	44
GMC	401	V6	1	329	-	-	-
Ford	361	V8	3	334	293	377	42
Ford	330	V8	4	349	300	388	37

TABLE D-10. ROUND 2 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - CARBON MONOXIDE

Manufacturer	CID	Cyl.	Number In Group	Mean	Min	Max	Standard Deviation
Ford	300	6	17	0.84	0.31	1.04	0.19
Chevrolet	292	6	2	0.86	0.84	0.88	0.03
Ford	330	V8	4	0.87	0.52	1.22	0.29
Chevrolet	366	V8	2	0.94	0.76	1.11	0.25
GMC	350	V8	2	1.03	0.65	1.40	0.53
Ford	332	V8	1	1.03	-	-	-
Ford	240	[illegible]	3	1.07	0.64	1.64	0.50
IHC	345	V8	6	1.11	0.81	1.61	0.23
Chevrolet	250	6	4	1.16	0.94	1.45	0.24
GMC	292	6	5	1.34	0.56	1.99	0.55
IHC	304	V8	13	1.45	1.07	2.60	0.50
IHC	478	V8	7	1.54	0.87	1.82	0.31
Ford	391	V8	4	1.59	0.77	2.74	0.87
Ford	361	V8	3	1.82	1.41	2.12	0.37
Dodge	225	6	8	1.84	1.53	2.40	0.27
Dodge	318	V8	15	1.86	1.40	2.42	0.28
Chevrolet	350	V8	7	1.89	1.09	2.55	0.48
Ford	360	V8	5	2.20	1.71	2.55	0.30
White	400	6	5	2.36	0.94	3.81	1.03
Chevrolet	427	V8	2	2.39	2.18	2.59	0.29
Chevrolet	307	V8	11	2.55	1.91	3.19	0.45
IHC	392	V8	23	2.63	1.71	6.56	1.00
GMC	401	V6	1	4.75	-	-	-

TABLE D-11. ROUND 2 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - OBSERVED NITRIC OXIDE

Manufacturer	CID	Cyl.	Number In Group	Mean	Min.	Max.	Standard Deviation
Chevrolet	366	V8	2	784	483	1084	425
GMC	401	V6	1	855	-	-	-
Chevrolet	427	V8	2	1158	927	1389	327
Chevrolet	350	V8	7	1312	996	1729	261
IHC	392	V8	23	1403	434	2173	431
Dodge	318	V8	18	1591	948	2457	405
IHC	478	V8	7	1630	1312	2289	387
Ford	360	V8	5	1780	1451	2172	277
White	400	6	5	1836	1512	2241	306
Chevrolet	307	V8	11	1838	1199	2336	314
GMC	350	V8	2	1854	1807	1900	66
Ford	361	V8	3	1867	1651	2088	219
Ford	240	6	3	1936	1703	2241	276
Ford	302	V8	1	2001	-	-	-
IHC	304	V8	13	2121	1257	2711	371
GMC	292	6	5	2200	1221	3136	695
Ford	300	6	17	2262	1075	3488	736
Ford	391	V8	4	2287	1947	2638	321
Dodge	225	6	8	2308	2117	2479	125
IHC	345	V8	8	2321	1897	2770	293
Chevrolet	292	6	2	2539	2499	2579	57
Chevrolet	250	6	4	2663	2628	2732	48
Ford	330	V8	4	2953	2734	3331	283

TABLE D-12. ROUND 2 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - CORRECTED NITRIC OXIDE

Manufacturer	CID	Cyl.	Number In Group	Mean	Min	Max	Standard Deviation
Chevrolet	366	V8	2	815	483	1146	469
GMC	401	V6	1	858	-	-	-
Chevrolet	427	V8	2	1155	921	1386	331
Chevrolet	350	V8	7	1323	989	1677	259
IHC	392	V8	23	1431	429	2173	438
Dodge	318	V8	15	1603	881	2550	425
IHC	478	V8	7	1611	1246	2346	382
Ford	360	V8	5	1735	1481	2131	260
White	400	6	5	1741	1458	2079	270
Chevrolet	307	V8	11	1851	1260	2304	325
GMC	350	V8	2	1902	1845	1959	81
Ford	240	6	3	1939	1734	2184	228
Ford	361	V8	3	1965	1745	2194	225
Ford	302	V8	1	2009	-	-	-
IHC	304	V8	13	2117	1233	2683	391
Ford	300	6	17	2162	980	3314	675
GMC	292	6	5	2217	1226	3114	688
Ford	391	V8	4	2322	1947	2693	368
IHC	345	V8	8	2332	1958	2663	292
Chevrolet	250	6	4	2338	2218	2445	100
Dodge	225	6	8	2356	2161	2548	125
Chevrolet	292	6	2	2487	2394	2579	131
Ford	330	V8	4	2950	2686	3268	266

TABLE D-13, ROUND 3 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - HYDROCARBONS (PPM HEX.)

Manufacturer	CID	Cyl.	Number In Group	Mean	Min	Max	Standard Deviation
Chevrolet	366	V8	2	126	115	137	16
GMC	292	6	5	172	95	219	47
GMC	350	V8	2	177	139	215	54
Ford	300	6	14	179	102	251	42
Chevrolet	292	6	2	191	170	212	30
White	400	6	5	208	140	306	68
Dodge	225	6	8	208	182	248	25
Ford	302	V8	1	214	-	-	-
Ford	360	V8	5	231	163	274	43
IHC	304	V8	13	238	198	273	25
Ford	391	V8	4	253	190	316	61
Chevrolet	307	V8	10	253	185	426	74
Chevrolet	350	V8	7	255	167	364	69
IHC	345	V8	8	256	193	339	46
Chevrolet	250	6	4	259	222	293	34
Ford	240	6	3	281	274	289	8
IHC	478	V8	7	288	231	506	99
IHC	392	V8	23	294	185	539	85
Dodge	318	V8	15	294	221	378	43
Ford	361	V8	3	309	305	312	4
GMC	401	V6	1	312	-	-	-
Ford	330	V8	4	337	278	406	60
Chevrolet	427	V8	2	1042	245	1838	1126

TABLE D-14. ROUND 3 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - CARBON MONOXIDE (PERCENT)

Manufacturer	CID	Cyl.	Number In Group	Mean	Min.	Max	Standard Deviation
Chevrolet	292	6	2	0.89	0.84	0.93	0.06
Ford	300	6	14	1.10	0.19	4.55	1.28
GMC	292	6	5	1.12	0.63	1.91	0.53
IHC	345	V8	8	1.20	0.92	1.52	0.21
IHC	304	V8	13	1.39	0.86	2.14	0.36
GMC	350	V8	2	1.45	1.07	1.83	0.54
Chevrolet	250	6	4	1.47	1.09	1.84	0.31
Ford	391	V8	4	1.50	0.72	2.41	0.83
Chevrolet	366	V8	2	1.50	1.18	1.81	0.45
Ford	330	V8	4	1.52	0.83	3.05	1.08
Ford	302	V8	1	1.67	-	-	-
IHC	478	V8	7	1.69	1.28	2.78	0.52
Chevrolet	350	V8	7	1.74	1.06	2.49	0.53
Dodge	318	V8	15	1.77	1.39	2.24	0.24
Dodge	225	6	8	1.89	1.60	2.19	0.21
Ford	361	V8	3	2.11	1.54	2.41	0.49
Ford	360	V8	8	2.24	1.76	2.50	0.28
Ford	240	6	3	2.32	0.85	3.41	1.32
Chevrolet	307	V8	10	2.56	1.97	3.1	0.38
IHC	392	V8	23	2.76	1.38	11.92	2.11
Chevrolet	427	V8	2	2.88	2.07	3.68	1.14
White	400	6	5	3.09	1.67	4.23	1.02
GMC	401	V6	1	5.07	-	-	-

TABLE D-15. ROUND 1 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - OBSERVED NITRIC OXIDE (PPM)

Manufacturer	CID	Cyl.	Number In Group	Mean	Min.	Max	Standard Deviation
Chevrolet	427	V8	2	695	627	763	96
GMC	401	V6	1	899	-	-	-
Chevrolet	366	V8	5	948	775	1151	245
Chevrolet	350	V8	7	1458	1010	1829	268
Ford	240	6	3	1513	1106	2298	645
IHC	392	V8	23	1585	572	2233	498
Dodge	318	V8	18	1744	805	2632	429
IHC	478	V8	7	1756	1325	2414	363
Ford	360	V8	5	1761	1521	1913	155
White	400	6	5	1766	717	2515	682
Chevrolet	307	V8	10	1866	1642	2425	248
Ford	361	V8	3	1873	1786	1929	76
Ford	302	V8	1	1986	-	-	-
GMC	350	V8	2	1988	1896	2080	130
IHC	345	V8	8	2219	1939	2461	162
Ford	300	6	14	2293	1140	3011	537
Ford	391	V8	4	2306	1984	2655	284
Dodge	225	6	8	2326	1912	2755	265
IHC	304	V8	13	2353	1771	2884	344
Chevrolet	250	6	4	2400	2295	2492	103
GMC	292	6	5	2422	1280	3445	770
Ford	330	V8	4	2562	1483	2973	844
Chevrolet	292	6	2	2586	2452	2719	189

TABLE D-16. ROUND 3 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - CORRECTED NITRIC OXIDE (PPM)

Manufacturer	CID	Cyl.	Number In Group	Mean	Min	Max	Standard Deviation
Chevrolet	427	V8	2	687	625	749	87.7
Chevrolet	366	V8	2	885	784	985	142.1
GMC	401	V6	1	899	-	-	-
Chevrolet	350	V8	7	1377	884	1599	249.7
Ford	240	6	3	1496	1110	2242	646.2
IHC	392	V8	23	1538	266	2332	482.4
IHC	478	V8	7	1669	1353	2205	301.4
Dodge	318	V8	18	1671	799	2521	435.1
Ford	360	V8	5	1743	1504	1934	161.8
White	400	6	5	1773	720	2543	688.2
GMC	350	V8	2	1865	1816	1914	69.3
Chevrolet	307	V8	10	1879	1532	2331	214.3
Ford	361	V8	3	1888	1859	1915	28.1
Ford	391	V8	4	1952	1680	2206	293.1
Ford	302	V8	1	1956	-	-	-
Ford	300	6	14	2285	1168	3879	825.2
IHC	345	V8	8	2310	2066	2616	204.5
Dodge	225	6	8	2346	1946	2628	245.9
IHC	304	V8	13	2373	1790	2843	316.7
Chevrolet	250	6	4	2378	2279	2475	101.8
GMC	292	6	5	2386	1226	3672	871.0
Chevrolet	292	6	2	2582	2435	2730	208.6
Ford	330	V8	4	2586	1027	3006	546.8

TABLE D-17. ROUND 4 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - HYDROCARBONS (PPM HEX.)

Manufacturer	CID	Cyl	Number In Group	Mean	Min	Max	Standard Deviation
Chevrolet	366	V8	2	155	121	188	48
Ford	300	6	14	192	120	272	40
GMC	351	V8	2	196	181	211	21
Chevrolet	250	6	7	200	121	290	62
GMC	292	6	5	200	125	291	65
White	400	6	5	202	129	311	74
Chevrolet	292	6	2	202	179	225	33
Chevrolet	307	V8	10	207	161	259	31
Chevrolet	427	V8	2	232	231	232	1
Ford	302	V8	1	235	-	-	-
Dodge	225	6	8	238	175	300	44
IHC	304	V8	13	242	166	324	34
IHC	345	V8	8	248	186	302	42
Ford	240	6	3	250	211	288	54
Ford	360	V8	5	251	237	272	13
Chevrolet	250	6	4	251	223	272	20
IHC	392	V8	21	266	177	483	66
Ford	391	V8	4	281	224	340	55
Dodge	318	V8	15	288	212	355	49
GMC	401	V6	1	298	-	-	-
Ford	361	V8	3	399	282	586	164
IHC	478	V8	7	572	153	1922	614
Ford	330	V8	4	811	253	2093	860

TABLE D-18. ROUND 4 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - CARBON MONOXIDE (PERCENT)

Manufacturer	CID	Cyl.	Number In Group	Mean	Min.	Max.	Standard Deviation
Ford	302	V8	1	0.97	-	-	-
Ford	300	6	14	1.01	0.15	4.78	1.33
Chevrolet	292	6	2	1.02	0.84	1.19	0.25
GMC	292	6	5	1.14	0.51	1.96	0.64
Chevrolet	366	V8	2	1.21	0.78	1.66	0.55
Chevrolet	250	6	4	1.23	0.68	1.8	0.48
IHC	345	V8	8	1.30	0.91	1.62	0.22
IHC	304	V8	13	1.34	0.86	2.24	0.39
IHC	478	V8	7	1.48	0.80	1.97	0.44
Chevrolet	350	V8	7	1.56	0.87	2.37	0.55
Ford	330	V8	4	1.71	0.73	3.89	1.49
GMC	350	V8	2	1.82	1.33	2.30	0.69
Dodge	318	V8	15	1.83	1.45	2.23	0.25
Ford	240	6	3	1.85	1.82	1.87	0.04
Ford	361	V8	3	1.87	1.55	2.48	0.53
Ford	391	V8	4	1.93	0.74	3.36	1.29
Dodge	225	6	8	1.96	1.44	2.17	0.26
Ford	360	V8	5	2.24	1.55	2.90	0.52
Chevrolet	427	V8	2	2.34	1.82	2.85	0.73
IHC	392	V8	21	2.38	1.65	3.96	0.55
Chevrolet	307	V8	10	2.55	1.94	3.24	0.13
White	400	6	5	2.64	1.44	3.35	0.75
GMC	401	V6	1	4.90	-	-	-

TABLE D-19. ROUND 4 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - OBSERVED NITRIC OXIDE (PPM)

Manufacturer	CID	Cyl.	Number In Group	Mean	Min.	Max.	Standard Deviation
Chevrolet	366	V8	2	690	439	941	355
GMC	401	V6	1	904	-	-	-
Chevrolet	427	V8	2	1020	591	1448	606
Chevrolet	350	V8	7	1118	844	1438	185
IHC	392	V8	21	1397	717	2143	368
IHC	478	V8	7	1404	1035	1755	260
GMC	350	V8	2	1498	1437	1559	86
Ford	240	6	3	1627	1088	2165	764
Dodge	318	V8	15	1634	946	2408	396
Ford	360	V8	5	1659	1537	1853	128
Chevrolet	307	V8	10	1730	1071	2329	409
Ford	361	V8	3	1816	1120	2364	635
White	400	6	5	1850	1484	2363	355
Ford	391	V8	4	1932	1438	2302	435
Ford	330	V8	4	2047	1553	2780	529
Dodge	225	6	8	2100	1454	2565	347
IHC	304	V8	13	2377	1492	2950	505
IHC	345	V8	8	2429	1829	2862	335
GMC	292	6	5	2496	1064	3681	1098
Ford	302	V8	1	2469	-	-	-
Ford	300	6	14	2478	1256	4008	849
Chevrolet	250	6	4	2608	2026	3134	228
Chevrolet	292	6	2	2659	2635	2683	34

TABLE D-20. ROUND 4 AVERAGE EMISSION INSPECTION RESULTS BY ENGINE MODEL - CORRECTED NITRIC OXIDE (PPM)

Manufacturer	CID	Cyl.	Number in Group	Mean	Min.	Max.	Standard Deviation
Chevrolet	366	V8	2	628	378	878	189
GMC	401	V6	1	795	-	-	-
Chevrolet	427	V8	2	981	591	1370	550
Chevrolet	350	V8	7	1143	819	1415	189
IHC	478	V8	7	1274	1011	1517	175
IHC	392	V8	21	1300	720	1865	324
Ford	240	6	3	1391	870	1735	510
Ford	360	V8	3	1478	1371	1629	109
Dodge	318	V8	15	1509	918	2072	311
GMC	350	V8	2	1517	1421	1613	136
White	400	6	5	1521	1140	1928	306
Chevrolet	307	V8	10	1578	1071	1969	86
Ford	361	V8	3	1599	1054	2090	520
Ford	391	V8	4	1910	1411	2269	425
Ford	330	V8	4	1944	1267	2727	607
IHC	345	V8	8	2008	1648	2274	228
Dodge	225	6	8	2034	1460	2447	342
IHC	304	V8	13	2138	1482	2582	373
Chevrolet	250	6	4	2145	1653	2698	214
Ford	302	V8	1	2262	-	-	-
Ford	300	6	14	2293	1150	3172	780
GMC	292	6	5	2307	1001	3696	1164
Chevrolet	292	6	2	2455	2385	2524	98

Table D-21. Emission Results for Vehicles Requiring Timing or Idle Speed Adjustments
Heavy Duty Gasoline Surveillance - Four Month Inspection

[illegible]

TABLE D-22. EMISSION RESULTS FOR VEHICLES REQUIRING TIMING OR IDLE SPEED ADJUSTMENTS, HEAVY DUTY GASOLINE SURVEILLANCE - EIGHT MONTH INSPECTION

TABLE D-25. EMISSION RESULTS FOR SURVEILLANCE FLEET VEHICLES REQUIRING TIMING OR IDLE SPEED ADJUSTMENTS FTP USING CONTINUOUS NDIR - TWELVE MONTH INSPECTION

Unit No.	Date Tested	Truck No.	Source	Vehicle Year	Make	Engine CID	Cyl.	Trans. Speeds*	GVW lb.	Vehicle Type	Test Miles	Condition	Emission Results HC ppm	CO %	NO ppm Unc.	NO ppm Corr.	Unit No.
2	1-25-72	14899	P.O.D.	1970	Dodge	318	V-8	3-auto	10,000	Van	6,655	As received	252	1.51	2119	1649	2
								Timing 4° early				Adjusted	247	1.62	1538	1276	
4	1-28-72	PT46355	P.O.D.	1970	Dodge	318	V-8	3-auto	10,000	Van	11,620	As received	258	2.21	1481	1657	4
								Timing 10° early				Adjusted	256	2.26	1878	1790	
17	2-3-72	95	N.A.S.A.	1970	IHC	345	V-8	5	25,500	School Bus	28,000	As received	196	1.12	2209	1649	17
										Idle speed 175 rpm high		Adjusted	173	1.12	2309	1662	
22	2-7-72	5131	C.P.S.B.	1971	IHC	392	V-8	3-auto	25,500	Lime	9,119	As received	215	2.65	1491	1116	22
								Timing 10° early				Adjusted	163	2.58	937	756	
23	2-8-72	5130	C.P.S.B.	1970	IHC	392	V-8	3-auto	25,500	Lime	7,710	As received	201	1.65	1871	1520	23
								Timing 10° early				Adjusted	139	1.62	372	317	
47	3-5-72	312	C.W.B.	1970	IHC	304	V-8	4	19,700	Service	16,271	As received	262	0.94	2950	2518	47
								Timing 4° early				Adjusted	211	0.80	2800	2616	
56	3-9-72	315	C.W.B.	1970	IHC	304	V-8	4	19,700	Service	11,346	As received	225	1.22	2788	2221	56
								Timing 10° early				Adjusted	195	1.36	2497	2047	
58	3-14-72	316	C.W.B.	1970	IHC	304	V-8	4	19,700	Service	6,496	As received	181	1.15	1651	1482	58
								Timing 7° late				Adjusted	224	1.89	2526	2580	
59	3-14-72	317	C.W.B.	1970	IHC	304	V-8	4	19,700	Service	7,464	As received	266	1.36	2537	2307	59
								Timing 10° late				Adjusted	195	1.33	1883	1547	
64	3-1-72	582	Red Arrow	1970	Dodge	318	V-8	4	24,000	Freight	22,211	As received	259	1.18	1641	1692	64
								Timing 11° late				Adjusted	451	1.82	2379	2400	
66	3-16-72	241	C.W.B.	1970	Dodge	318	V-8	3	7,500	Maint.	10,921	As received	212	1.57	1460	1728	66
								Timing 5° late				Adjusted	226	1.49	1308	1615	
83	3-22-72	239	Navajo	1970	Ford	361	V-8	5	22,000	Freight	16,498	As received	329	1.57	1120	1096	83
								Timing 5° late				Adjusted	341	1.51	1258	1166	
84	3-21-72	248	Navajo	1970	Ford	361	V-8	5	22,000	Freight	21,981	As received	506	2.48	2364	2090	84
								Timing 6° early				Adjusted	382	2.56	1926	1701	
87	4-4-72	16-77	State comp.	1970	Dodge	427	6	3-auto	10,500	Grounds	1,460	As received	220	2.06	2314	2206	87
								Timing 5° early				Adjusted	194	1.96	2106	2208	
96	3-30-72	453	N.C.R.S.D.	1970	Ford	240	6	3	7,500	Maint.	17,219	As received	211	1.72	1089	870	96
								Timing 12° late, Idle speed 150 rpm low				Adjusted	311	1.94	1519	1560	
98	4-3-72	237	N.C.R.S.D.	1970	Ford	330	V-8	4	21,000	Water Tr.	16,227	As received	2045	0.91	4786	2727	98
								Timing 6° early				Adjusted	1444	0.82	1889	1114	
100	4-4-72	39	Southern	1970	Chevrolet	427	V-8	5	32,500	Moving	16,175	As received	221	2.05	911	941	100
								Timing 6° early, Idle speed 150 rpm high				Adjusted	229	2.94	865	665	
106	5-4-72	2279	C.P.B.	1970	Ford	360	V-8	4	6,300	Maint.	2,736	As received	250	1.97	1853	1629	106
								Timing 6° late				Adjusted	156	2.07	1224	1217	
121	5-6-72	98	Ryco	1970	GMC	292	6	4	10,000	Delivery	18,369	As received	2017	0.51	3661	3046	121
								Timing 17° early				Adjusted	132	0.49	2526	2555	
122	5-7-72	101	Ryco	1970	GMC	292	6	4	10,000	Delivery	18,990	As received	224	1.96	2746	2751	122
								Timing 7° early				Adjusted	196	1.98	2094	2157	
129	5-22-72	1388	Lone Star	1971	Ford	391	V-8	5	27,500	Delivery	19,056	As received	382	2.67	1646	1780	129
								Timing 4° late				Adjusted	305	2.44	1579	1586	
135	4-19-72	1385	S.A.P.W.	1971	IHC	392	V-8	4-auto	34,000	Garbage	11,491	As received	270	2.29	1751	1865	135
										Idle speed 400 rpm high		Adjusted	346	2.71	1917	1942	
137	4-25-72	1360	S.A.P.W.	1971	IHC	392	V-8	5-auto	34,000	Garbage	17,236	As received	321	2.66	1794	1562	137
								Timing 4° early				Adjusted	392	3.09	1284	1167	
151	5-1-72	197	Southern	1971	Chevrolet	427	V-8	5	32,500	Moving	24,926	As received	232	1.82	1469	1370	151
								Timing 7° late				Adjusted	299	1.67	2961	1933	

TABLE D-34. PERCENT CHANGE IN EMISSIONS FROM TIMING OR IDLE SPEED ADJUSTMENTS
6 MONTH INSPECTION

ROUND NO. 2

	HYDROCARBONS PPM				CARBON MONOXIDE PCT.				NITRIC OXIDE PPM				CORR. NO PPM			
TRUCK NUMBER	AS RECEIVED	TO SPEC	DIFF.	PCT. DIFF.	AS RECEIVED	TO SPEC	DIFF.	PCT. DIFF.	AS RECEIVED	TO SPEC	DIFF.	PCT. DIFF.	AS RECEIVED	TO SPEC	DIFF.	PCT. DIFF.
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AVERAGE PERCENT CHANGE [illegible]

TABLE D-25. PERCENT CHANGE IN EMISSIONS FROM TIMING OR IDLE SPEED ADJUSTMENTS
8 MONTH INSPECTIONS

[illegible]

	HYDROCARBONS PPM				CARBON MONOXIDE PCT.				NITRIC OXIDE PPM				[illegible]			
TRUCK NUMBER	AS RECEIVED	IN SPEC	DIFF.	PCT. DIFF.	AS RECEIVED	IN SPEC	DIFF.	PCT. DIFF.	AS RECEIVED	IN SPEC	DIFF.	PCT. DIFF.	AS RECEIVED	IN SPEC	DIFF.	PCT. DIFF.
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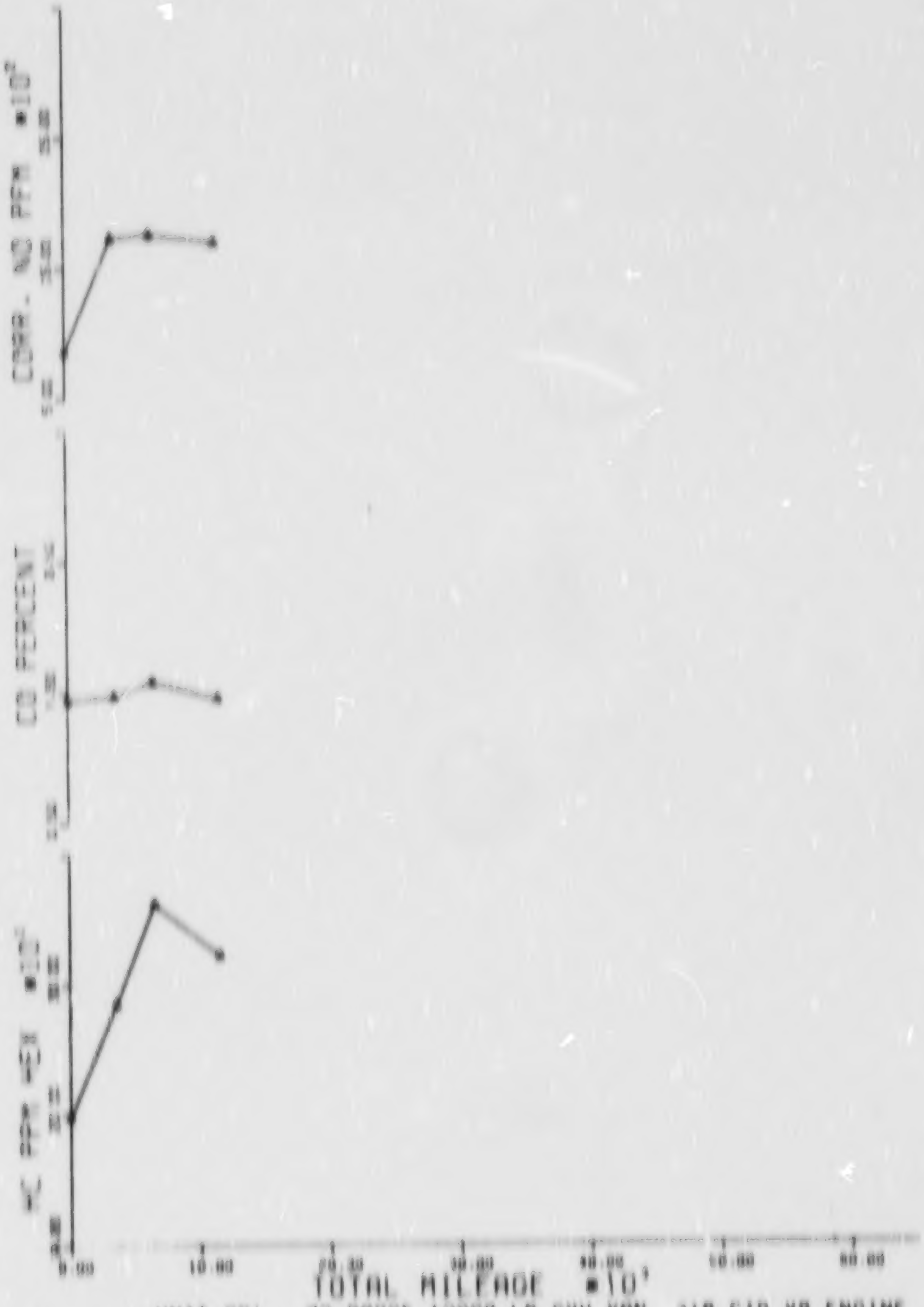
AVERAGE PERCENT CHANGE: HC [illegible]
CO [illegible]
NO [illegible]
[illegible] [illegible]

TABLE D-26. PERCENT CHANGE IN SURVEILLANCE FLEET CONTINUOUS NDIR EMISSIONS FROM TIMING OR IDLE SPEED ADJUSTMENTS - TWELVE MONTH INSPECTION

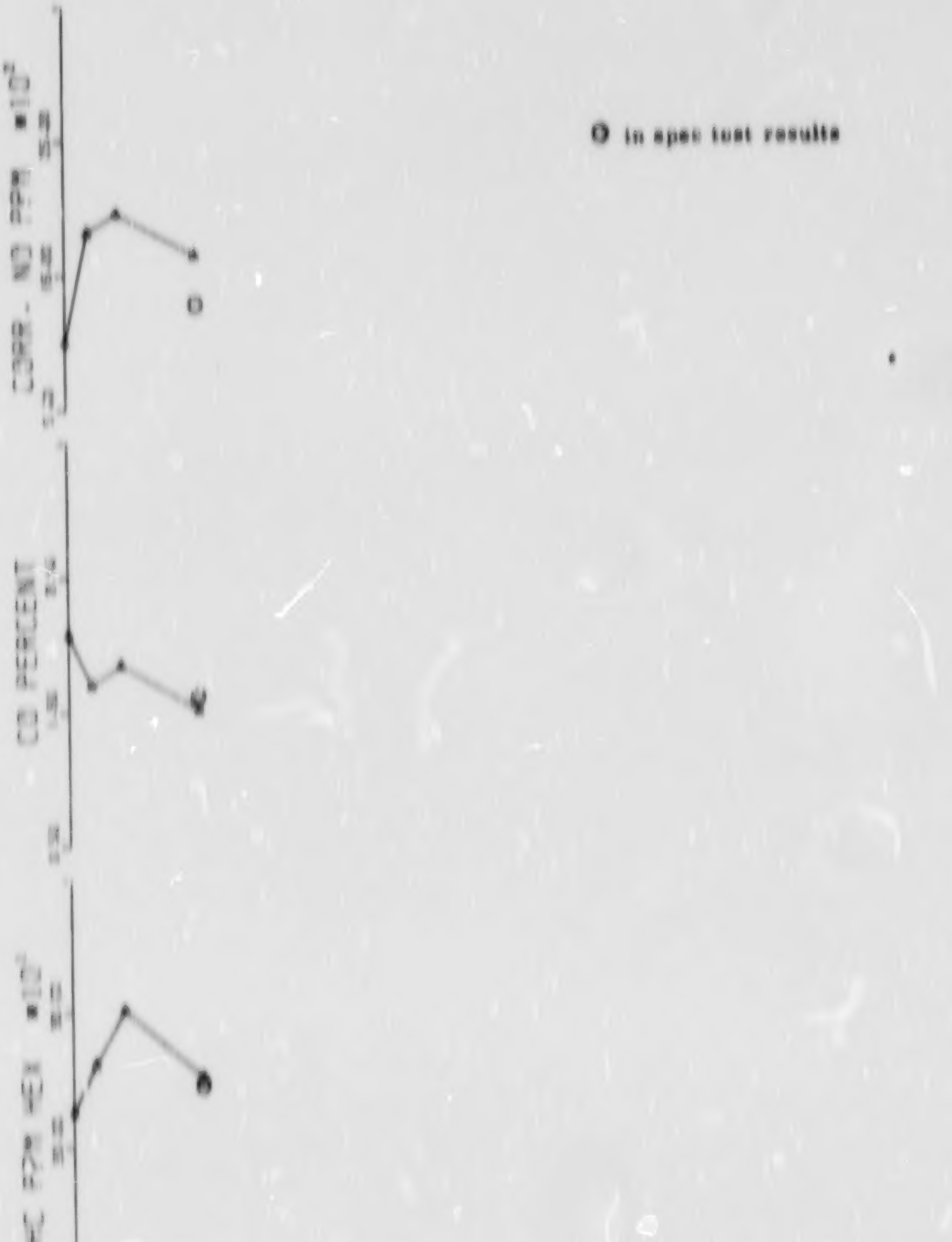
[illegible]

APPENDIX E

RESULTS OF FOUR INSPECTION ROUNDS BY INDIVIDUAL TRUCK



UNIT 001 70 DODGE 10000 LB GVW VAN 318 CID V8 ENGINE



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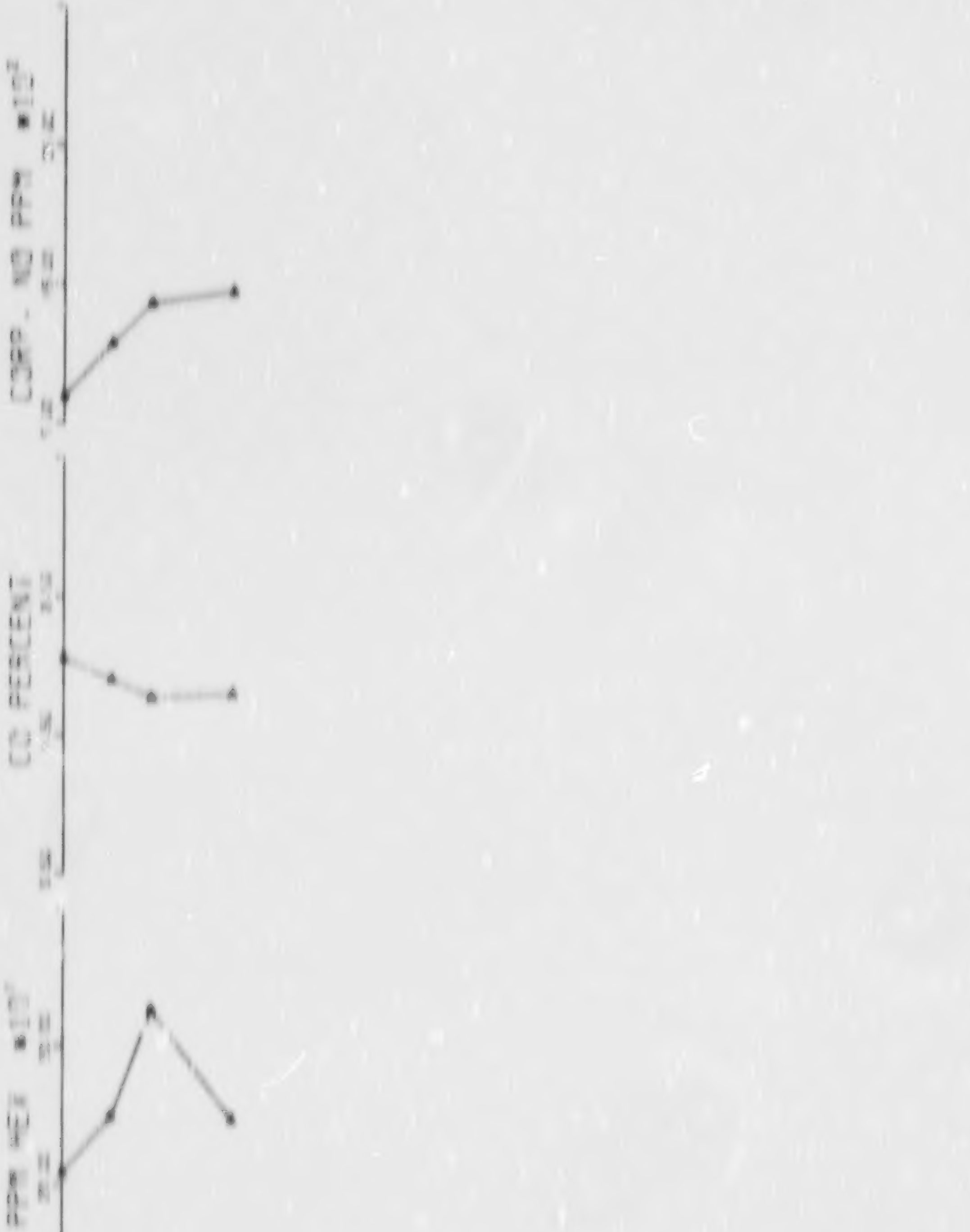

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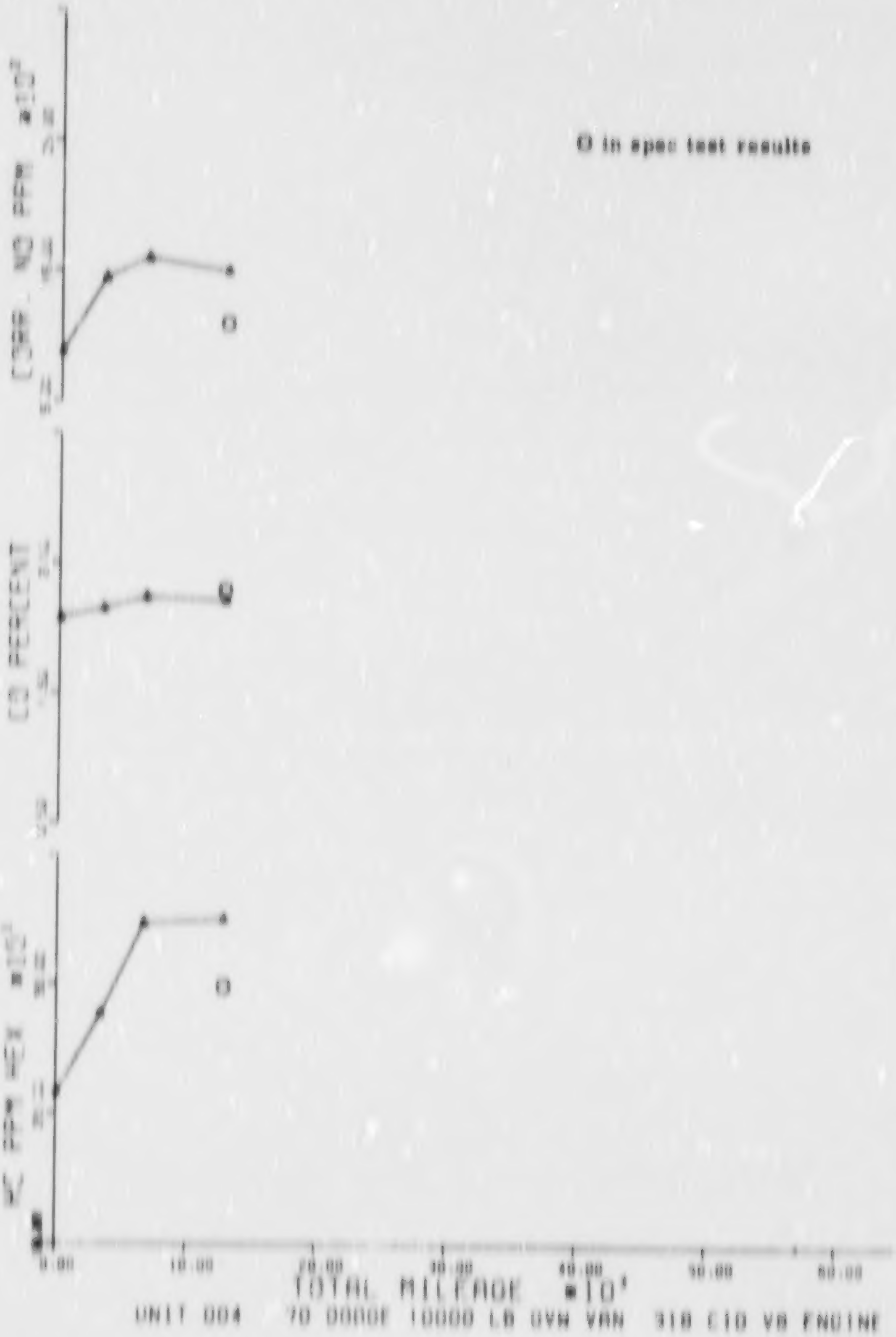

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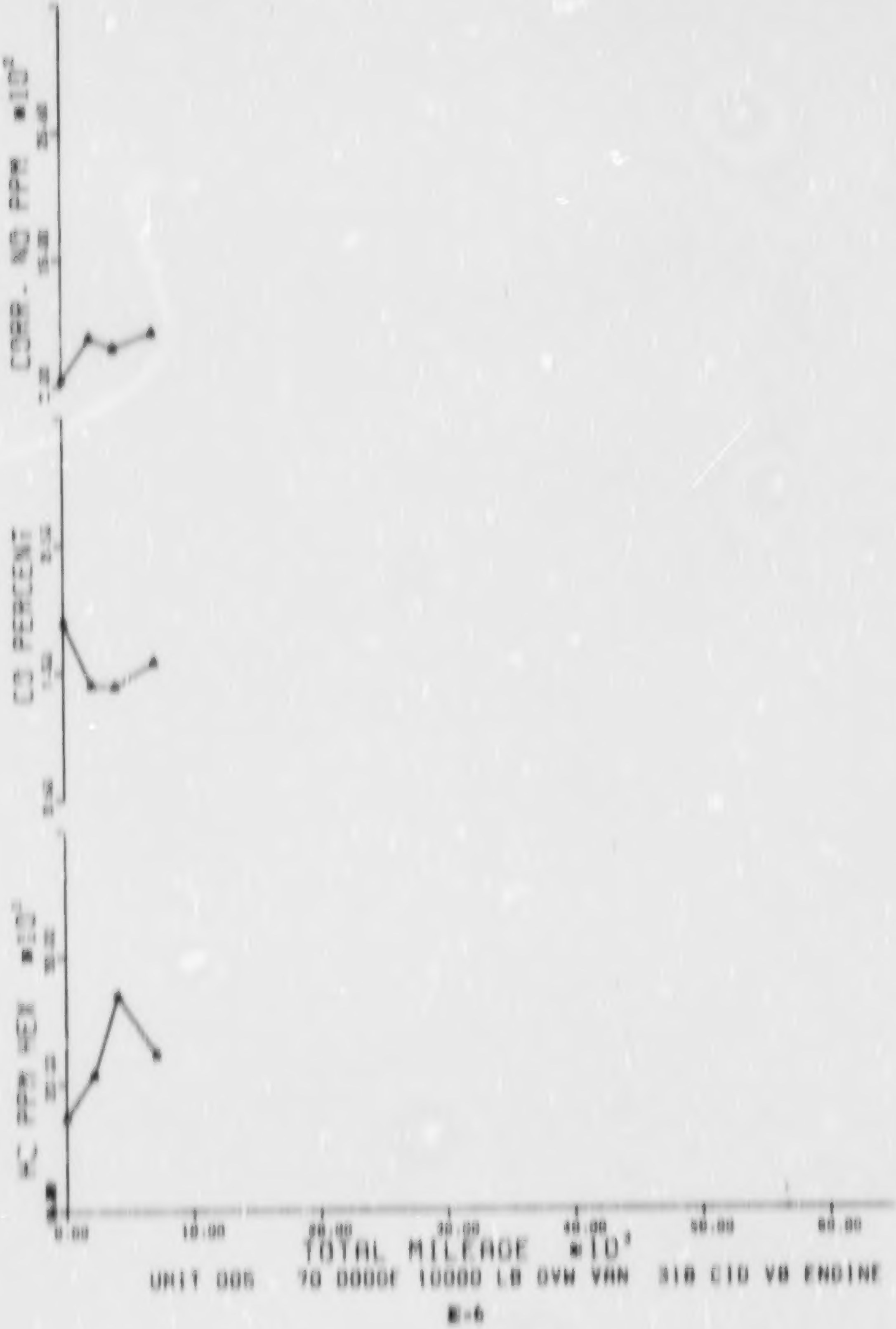
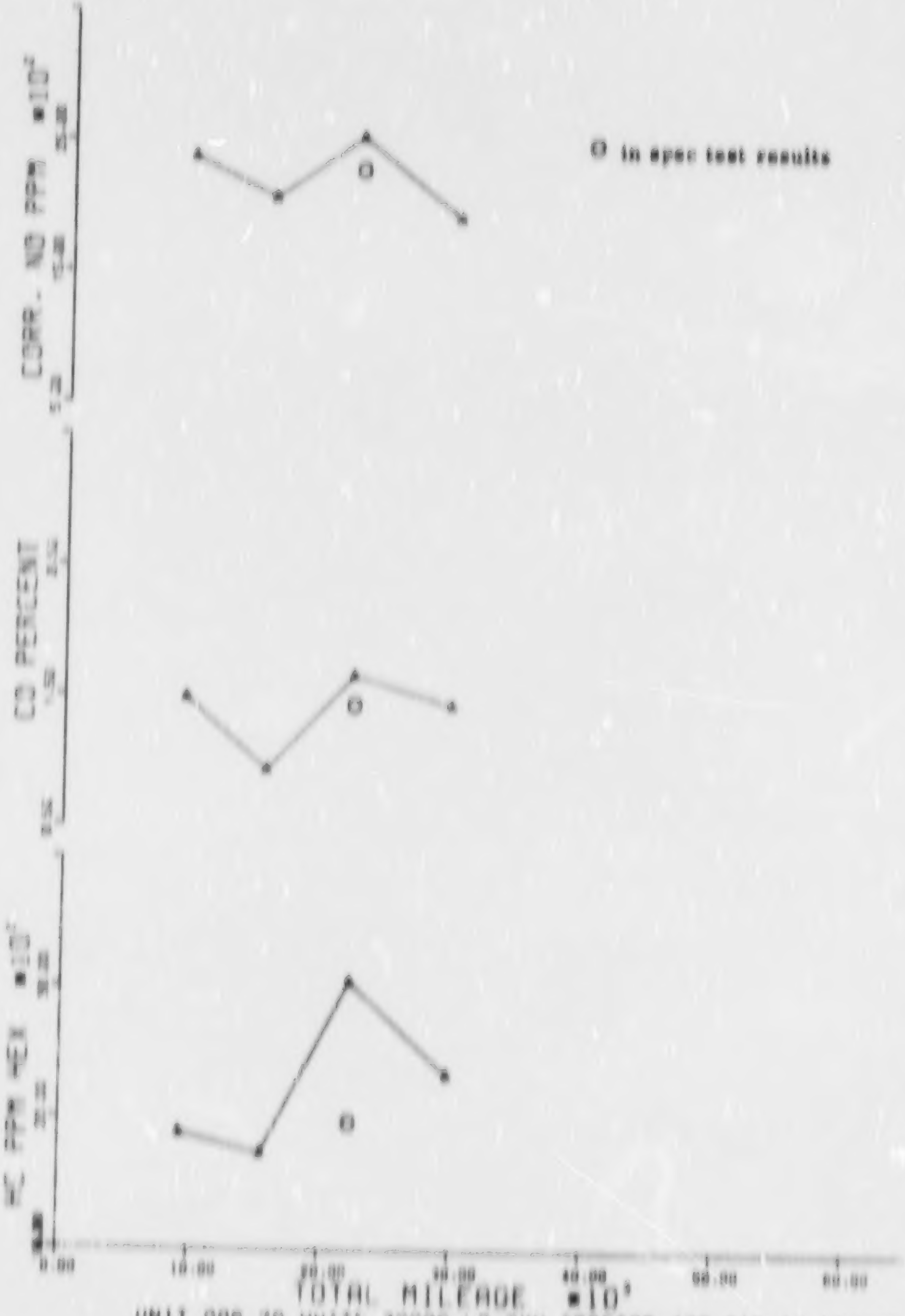
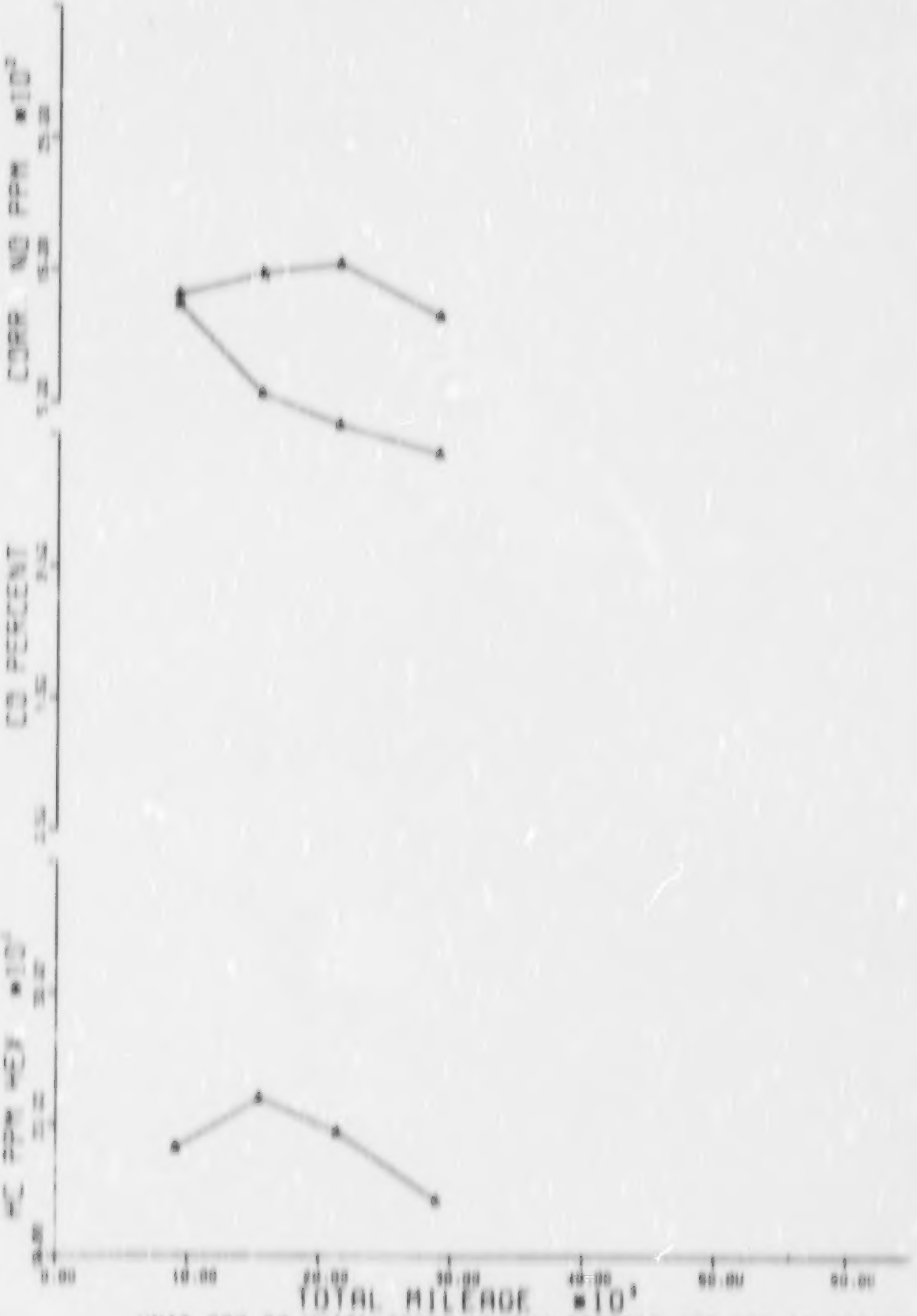


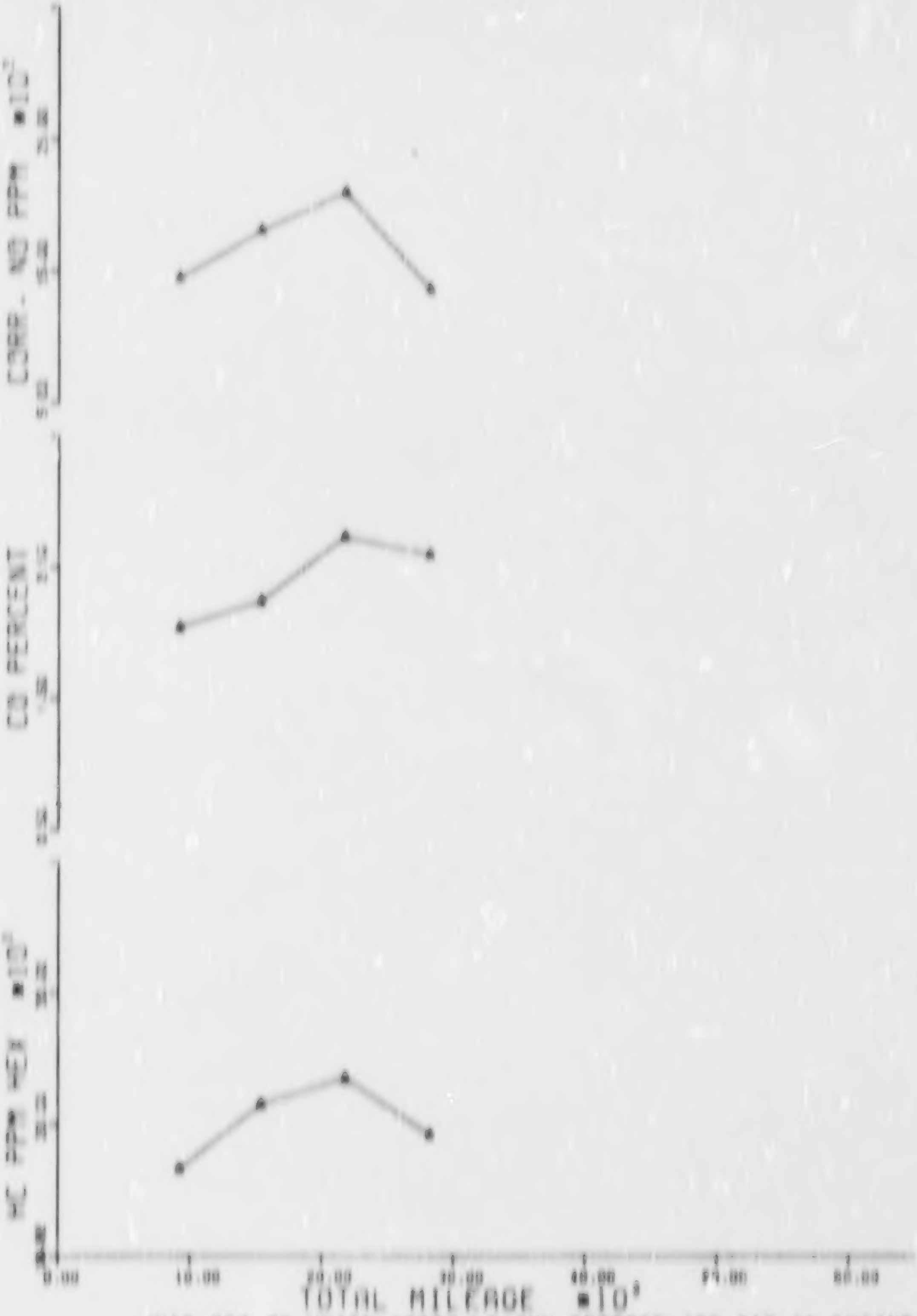
UNIT 005   70 DODGE 10000 LB GVW VAN   318 CID V8 ENGINE



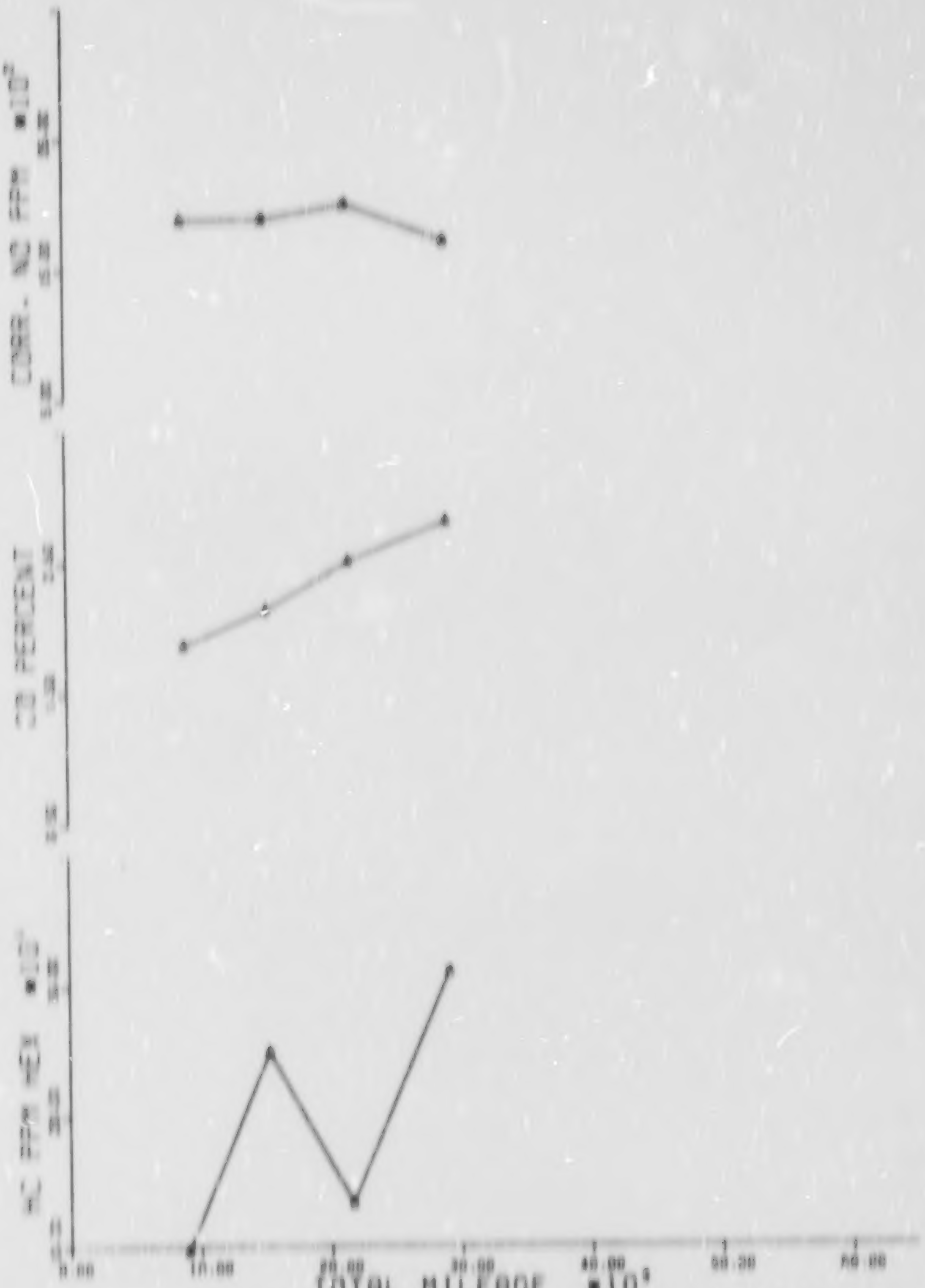
UNIT 008 70 WHITE 30000 LB GVW TRACTOR,400 CID I6 ENGINE



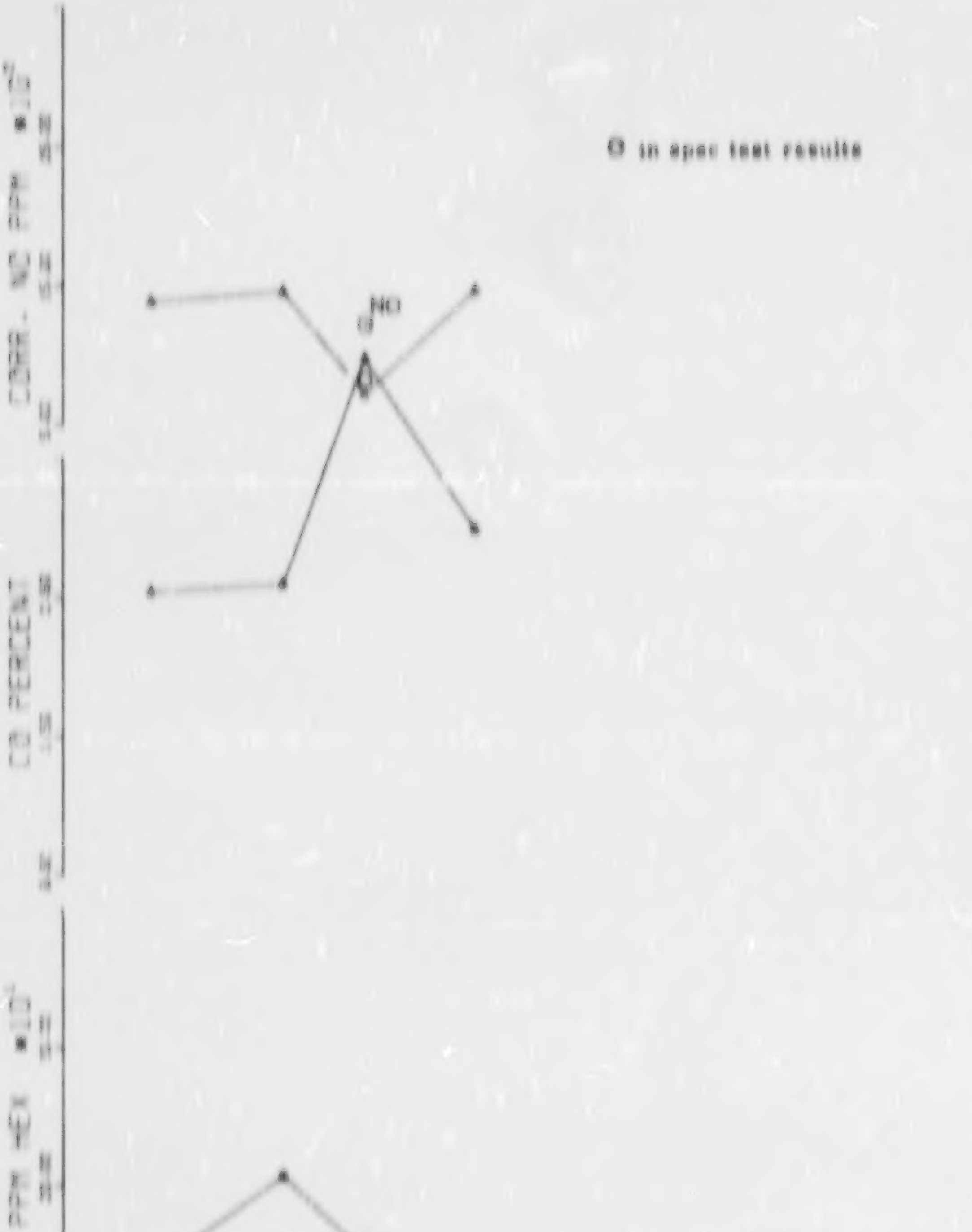
UNIT 007 70 WHITE 30000 LB GVW TRACTOR,400 CID I6 ENGINE



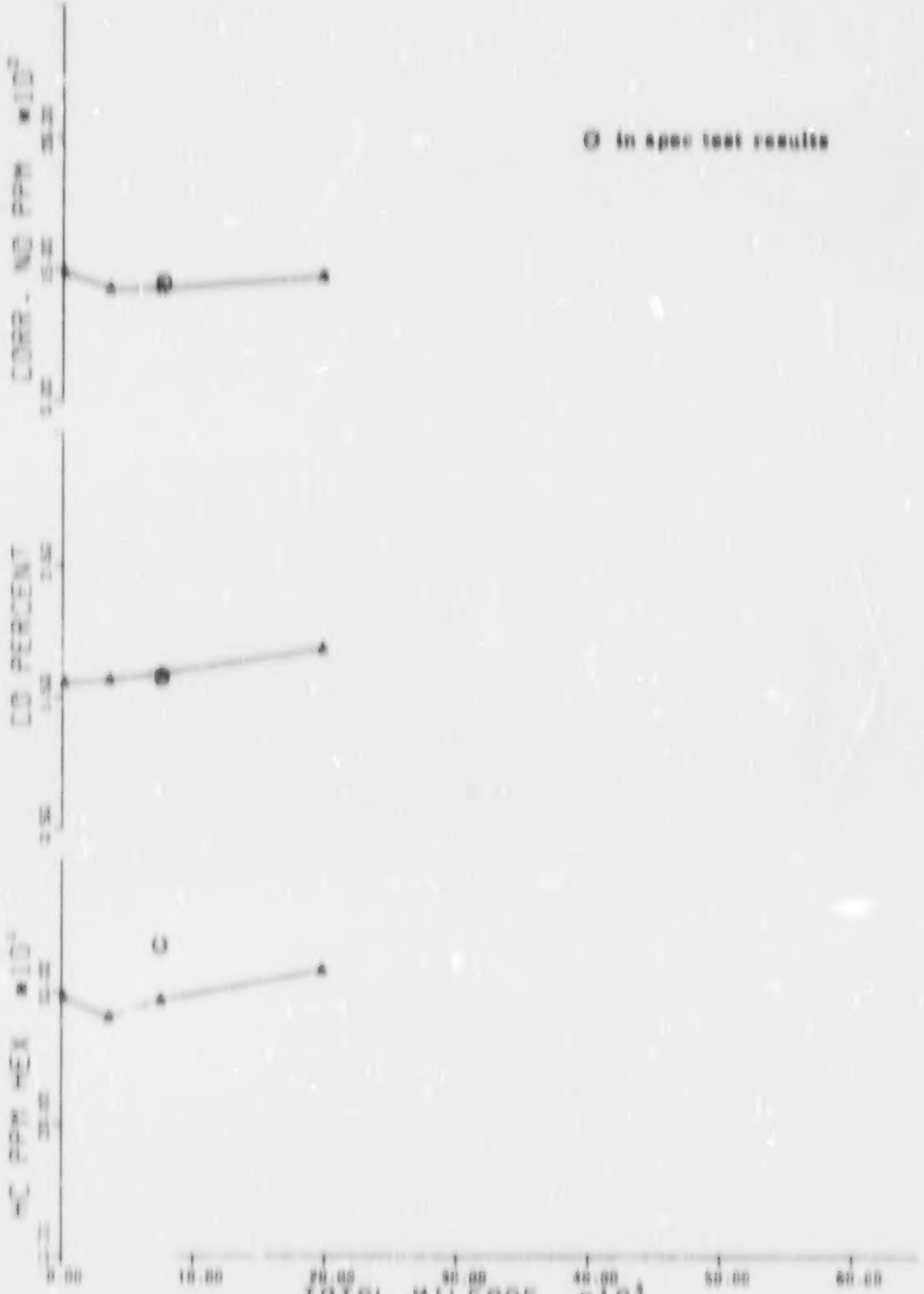
UNIT 008 70 WHITE 30000 LB GVW TRACTOR,400 CID I6 ENGINE



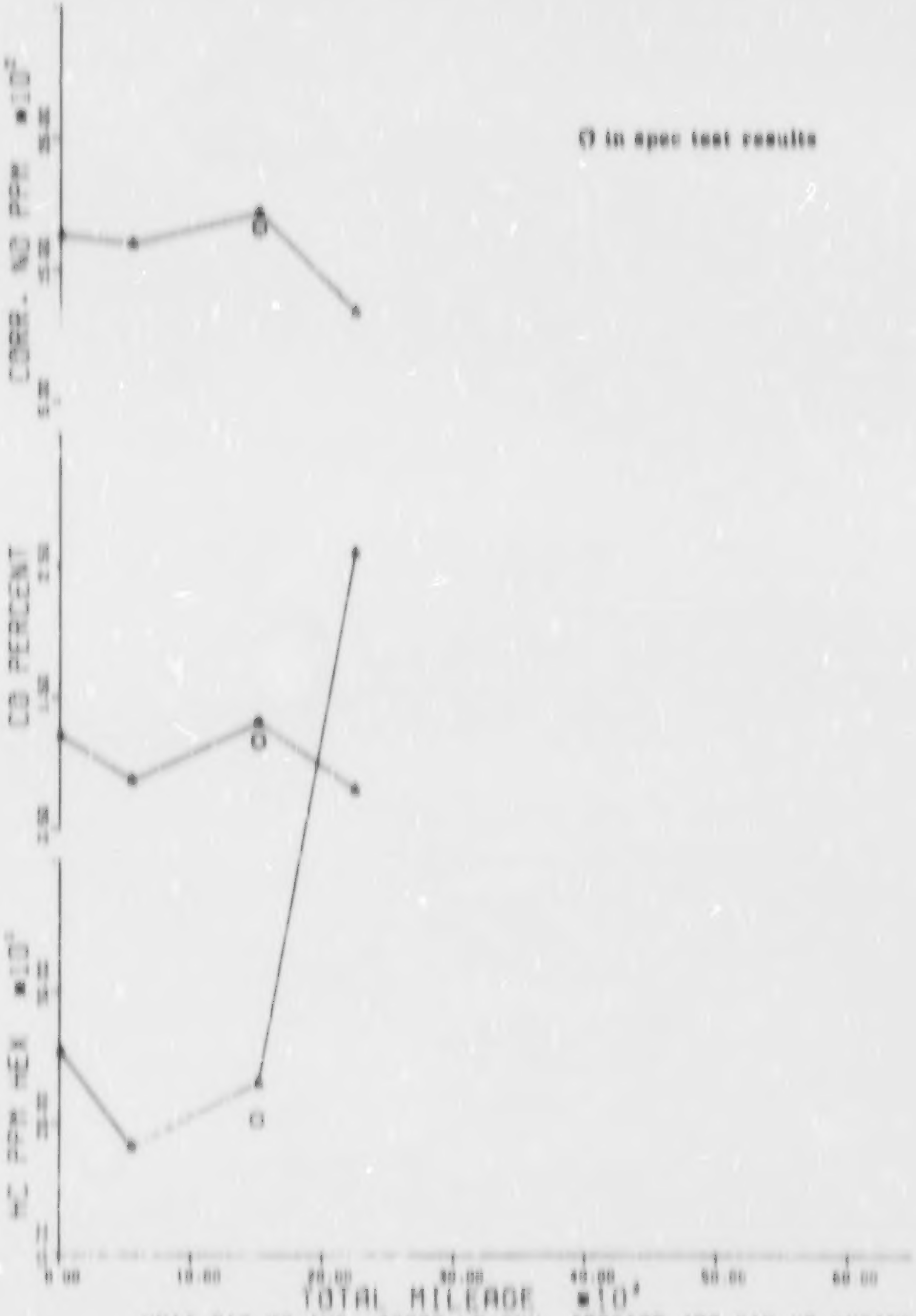
UNIT 009 70 WHITE 90000 LB GVW TRACTOR,400 CID I6 ENGINE



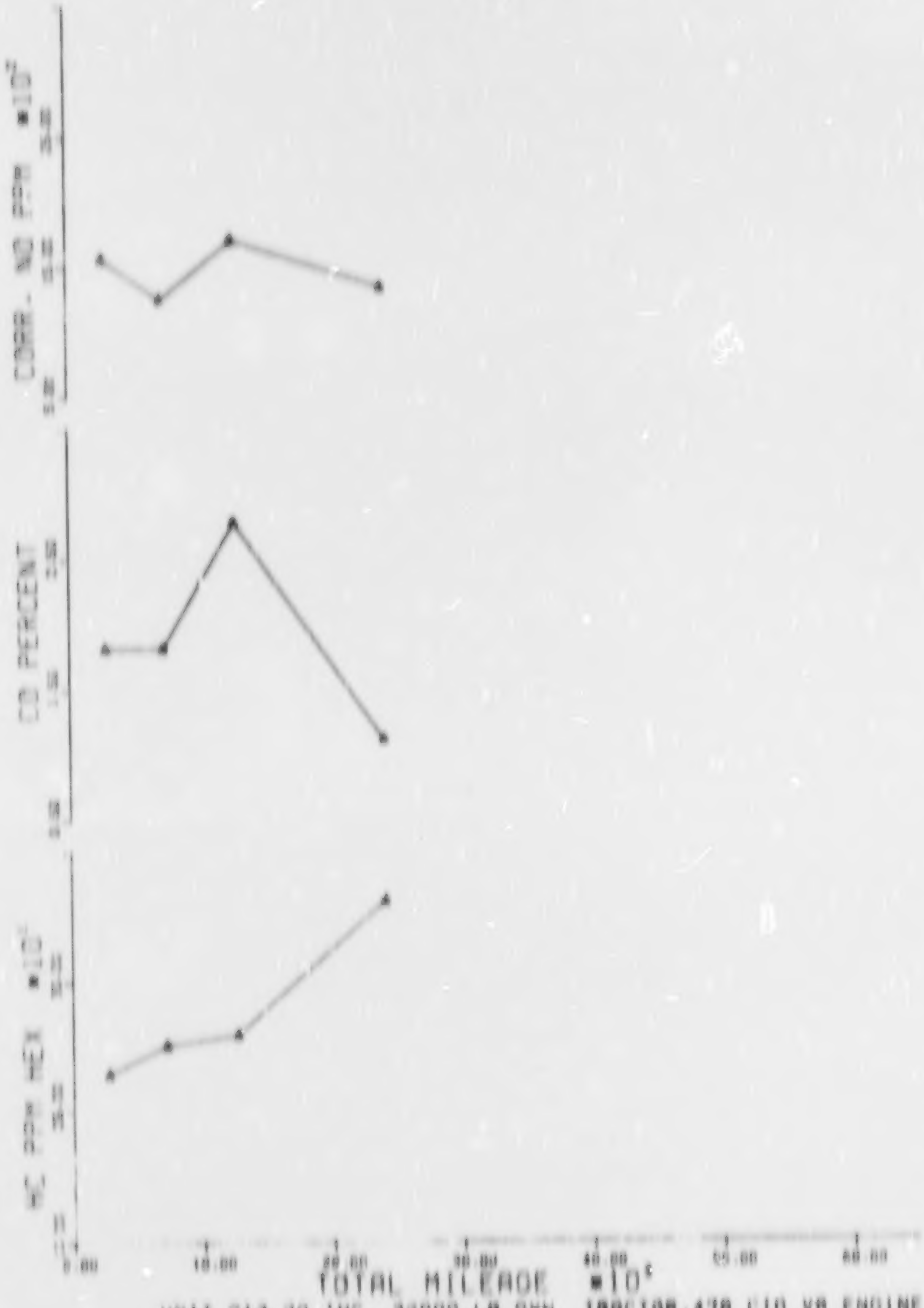
UNIT 010 70 WHITE 30000 LB GVW TRACTOR,400 CID V8 ENGINE



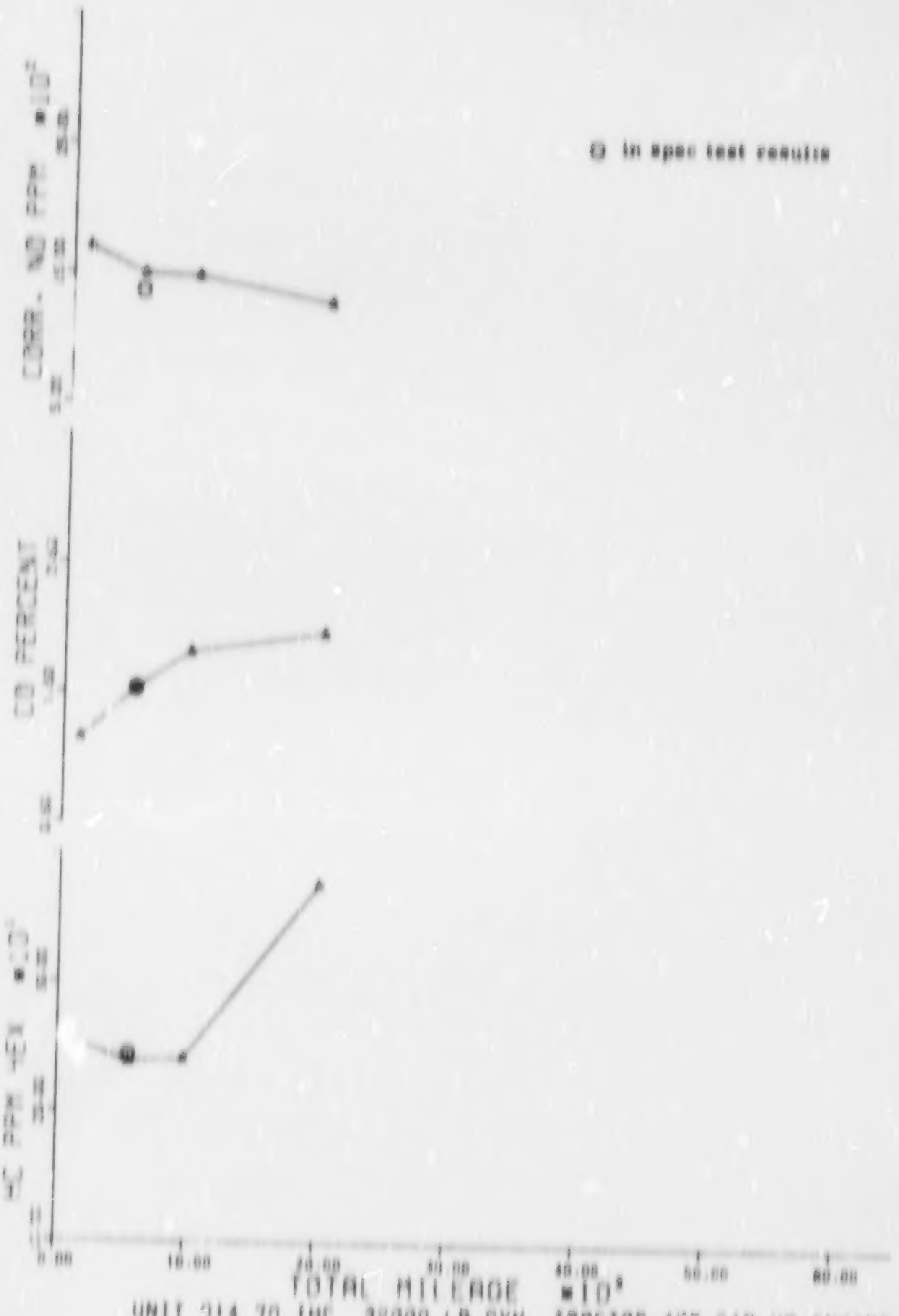
UNIT 011 70 IHC 32000 LB GVW TRACTOR,478 CID V8 ENGINE



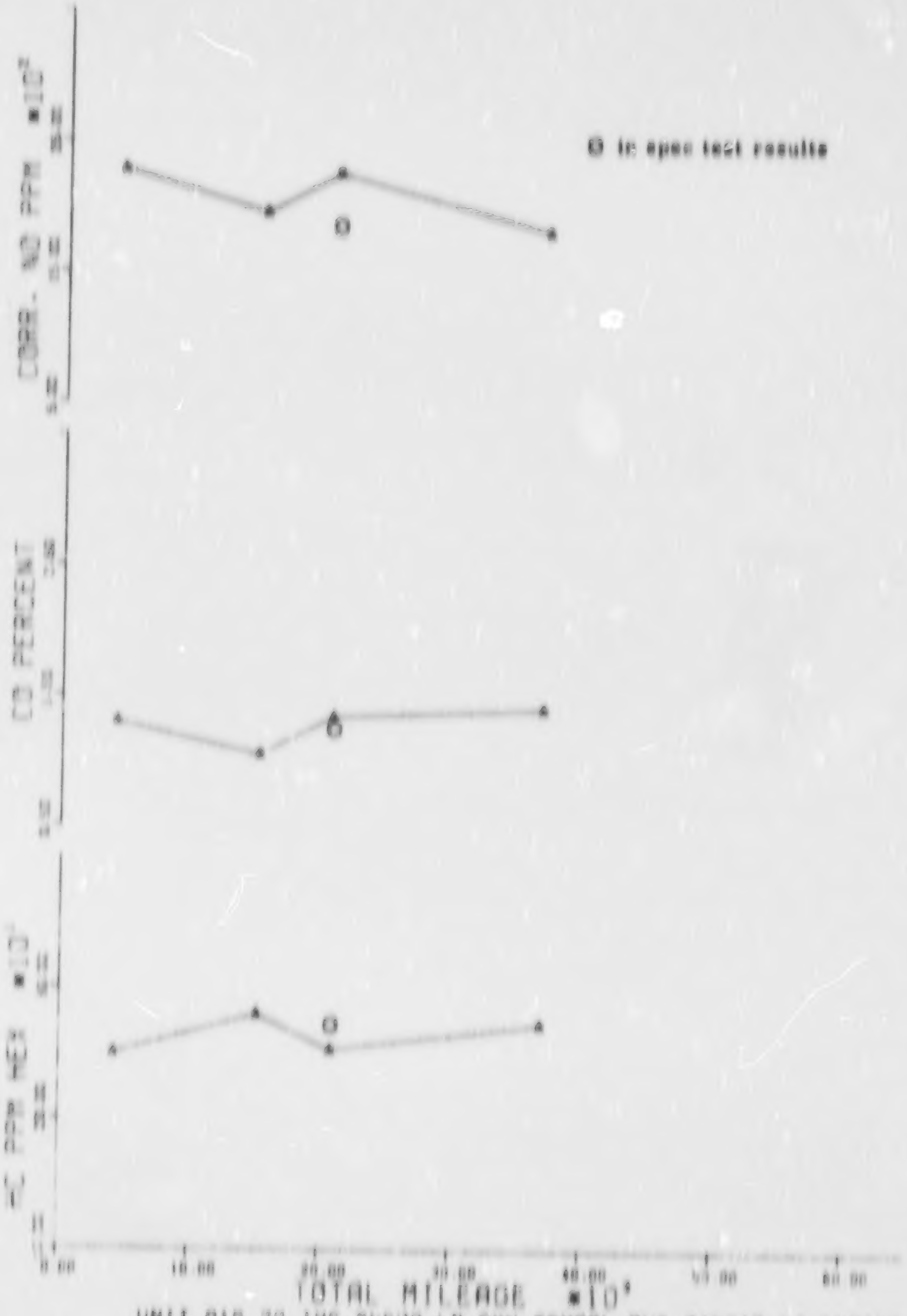
UNIT 012 70 IHC 32000 LB GVW TRACTOR,478 CID V8 ENGINE



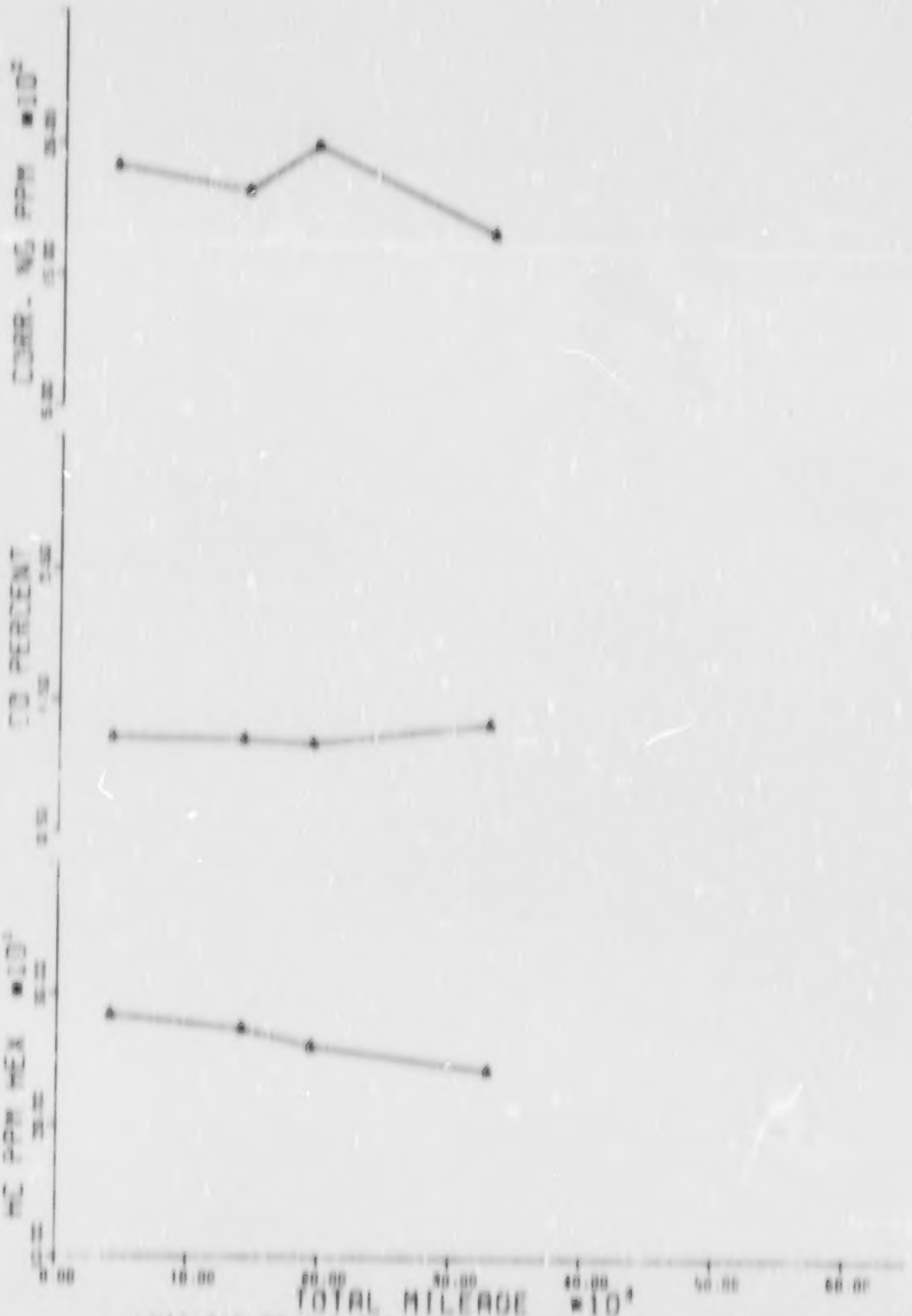
UNIT 013 70 IHC 32000 LB GVW TRACTOR,478 CID V8 ENGINE



UNIT 314 70 IHC 32000 LB GVW TRACTOR,476 CID V8 ENGINE

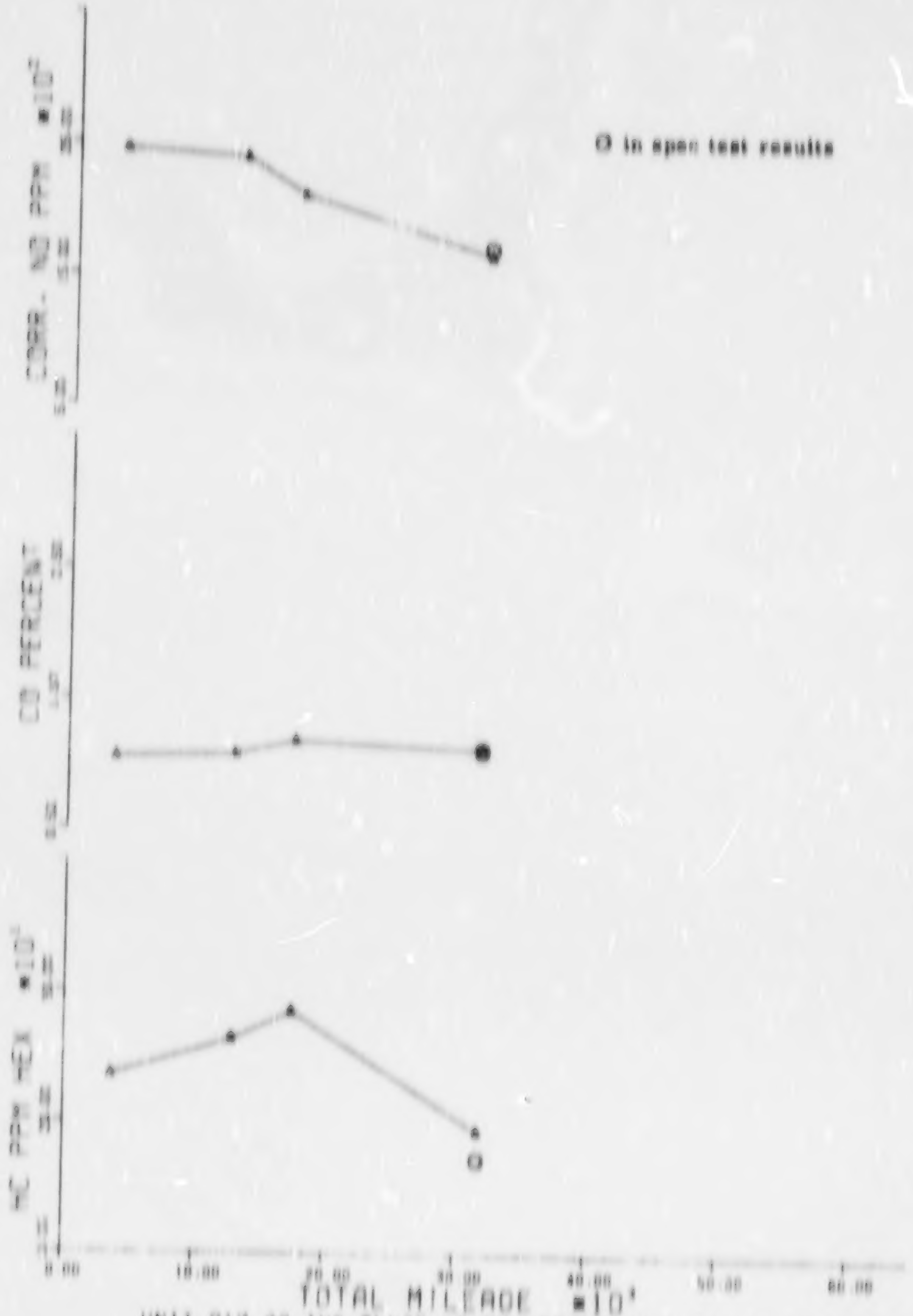


UNIT 015 70 IHC 25500 LB GVW SCHOOL BUS 345CID V8 ENGINE

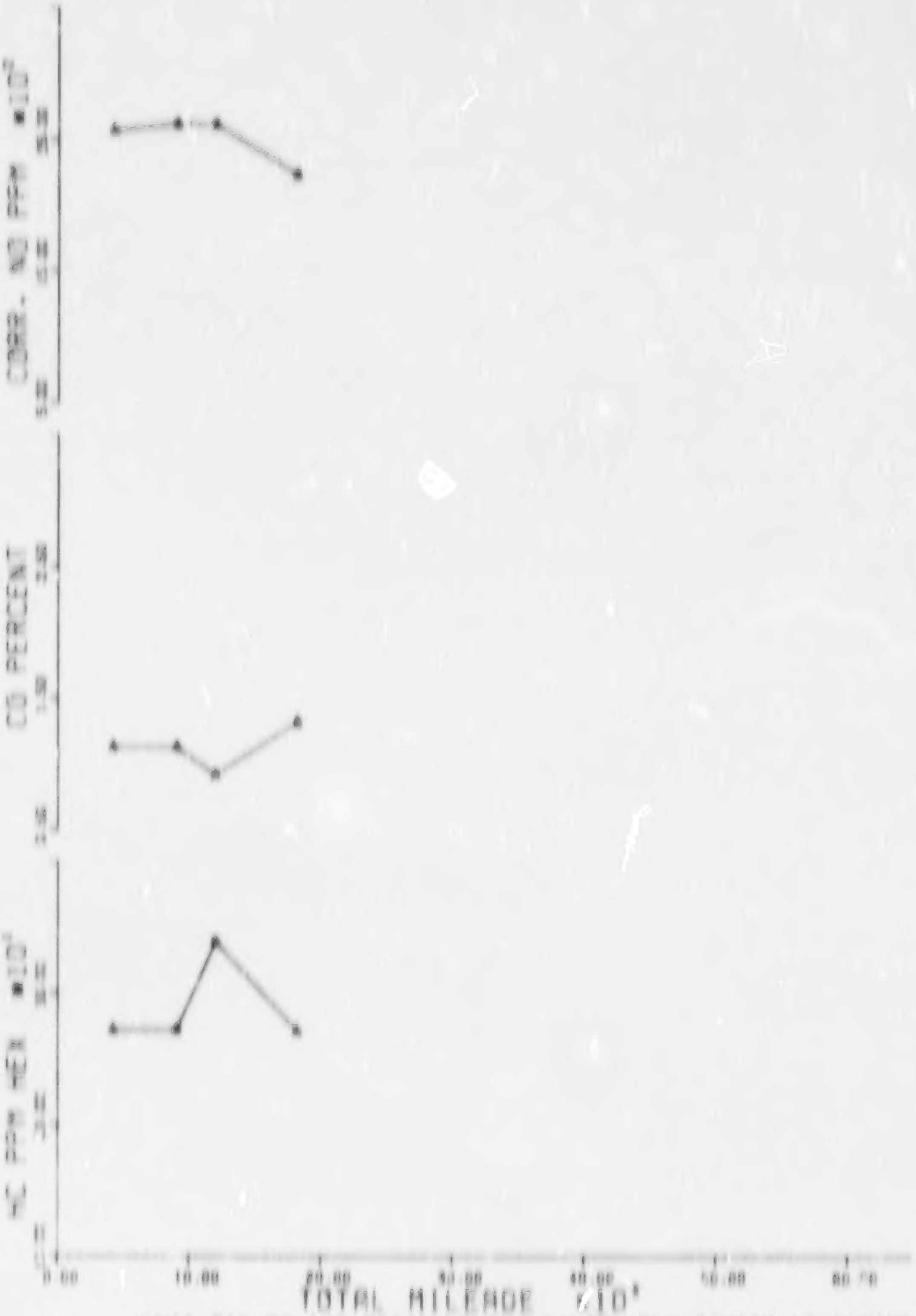


UNIT 018 TO THE 25500 LB GVW SCHOOL BUS 345CID V8 ENGINE

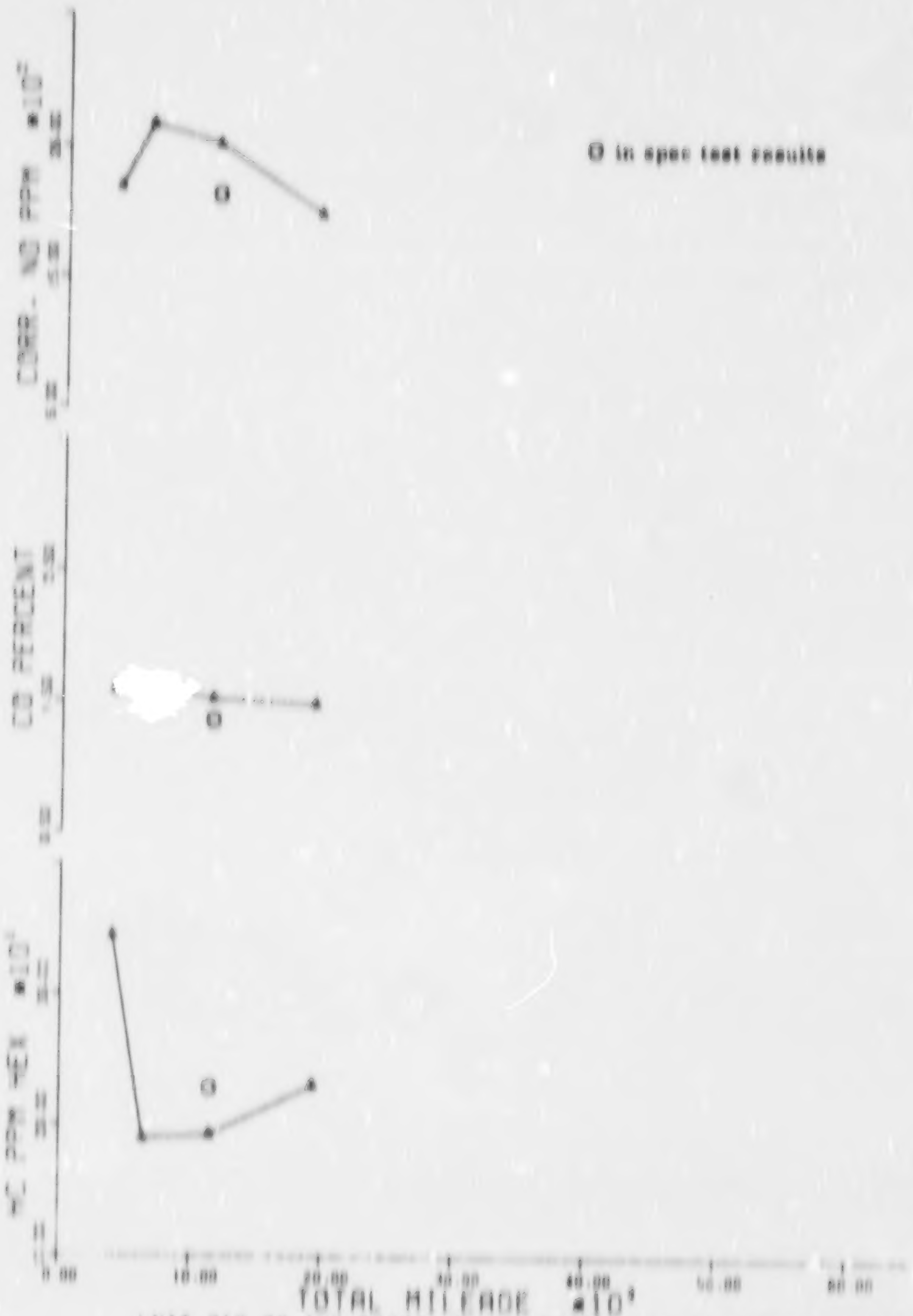
B-17



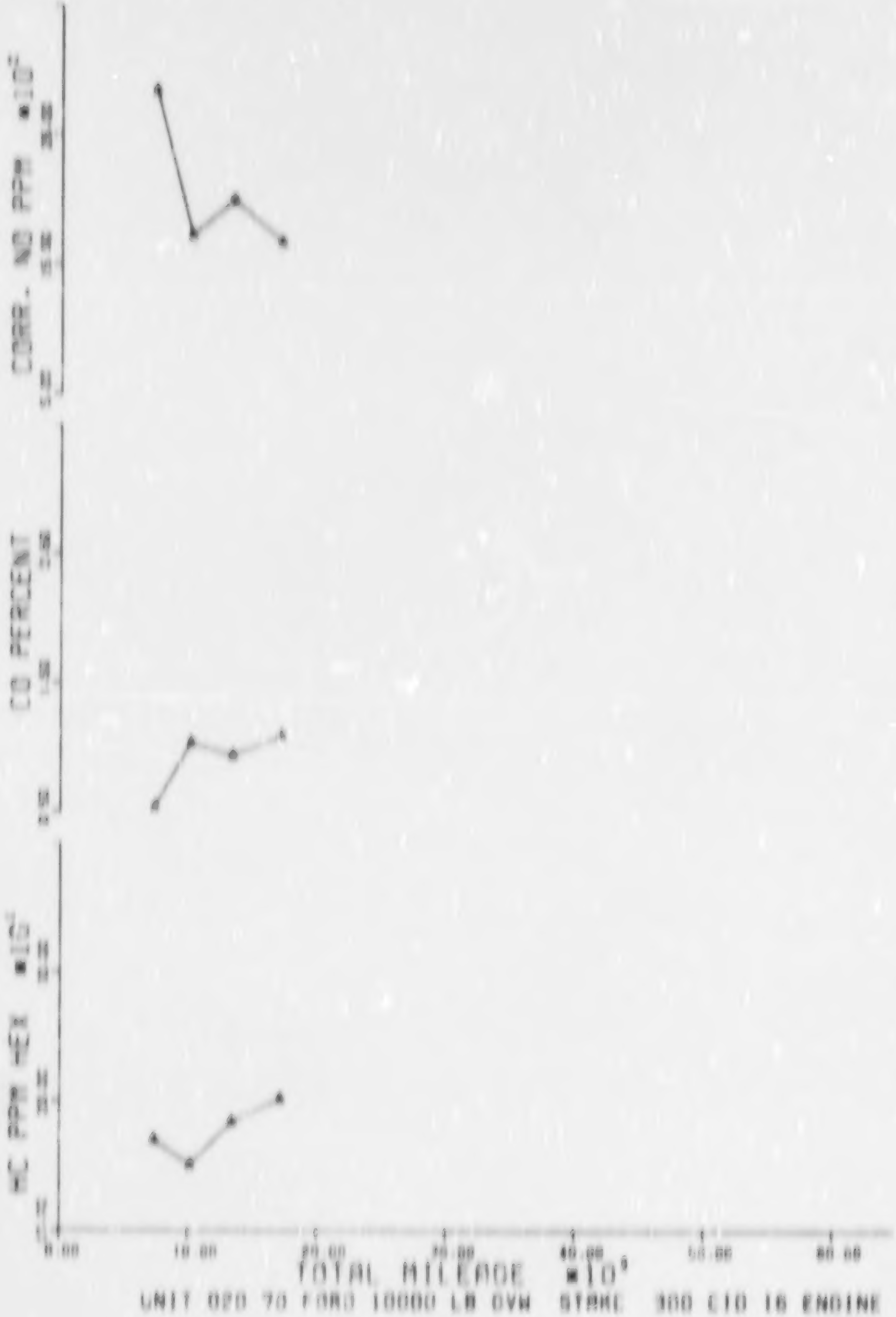
UNIT 017 TO IHC 25500 LB GVW SCHOOL BUS 345CID V8 ENGINE



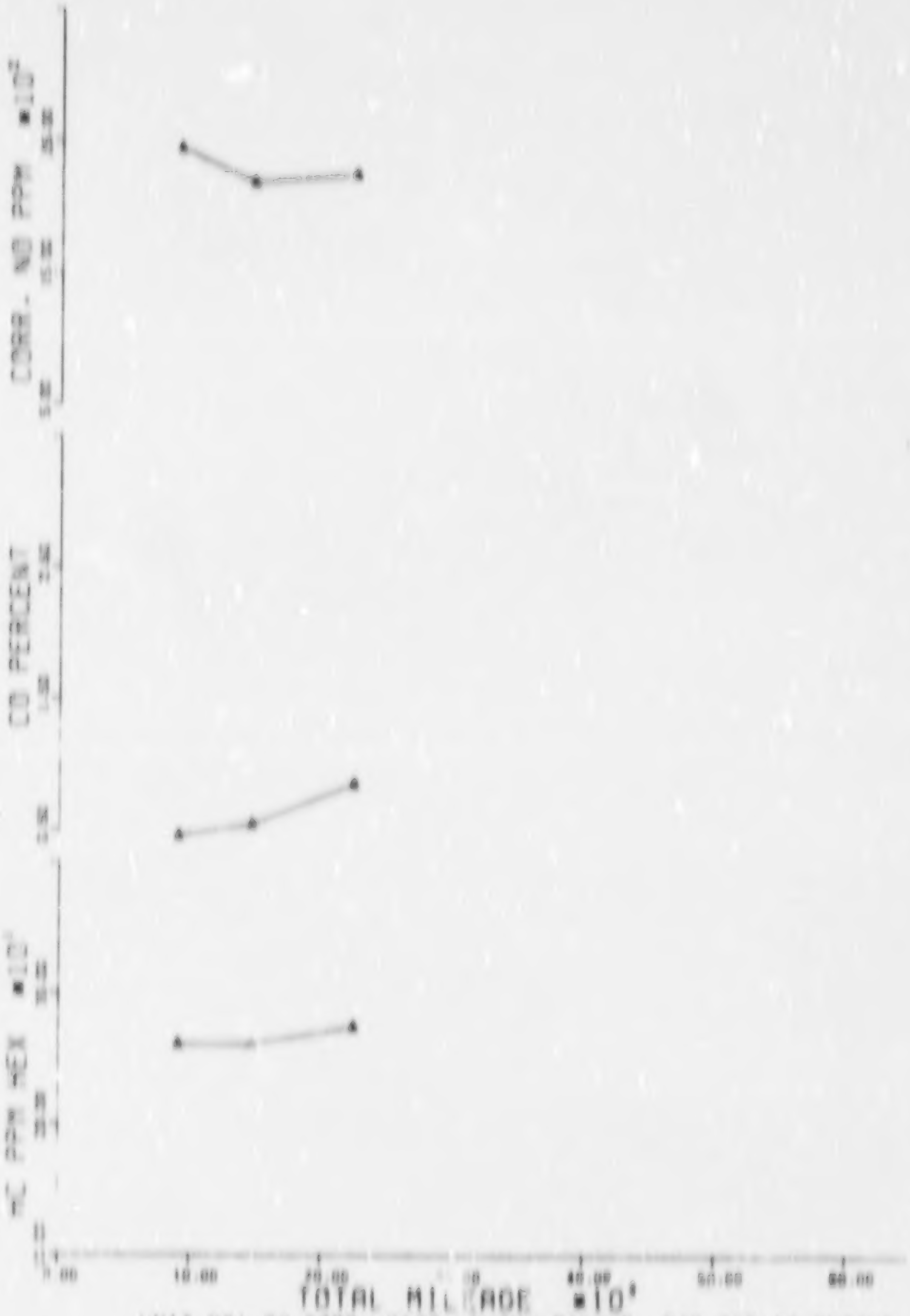
UNIT 018 70 IHC 22000 LB GVW SCHOOL BUS 345CID V8 ENGINE



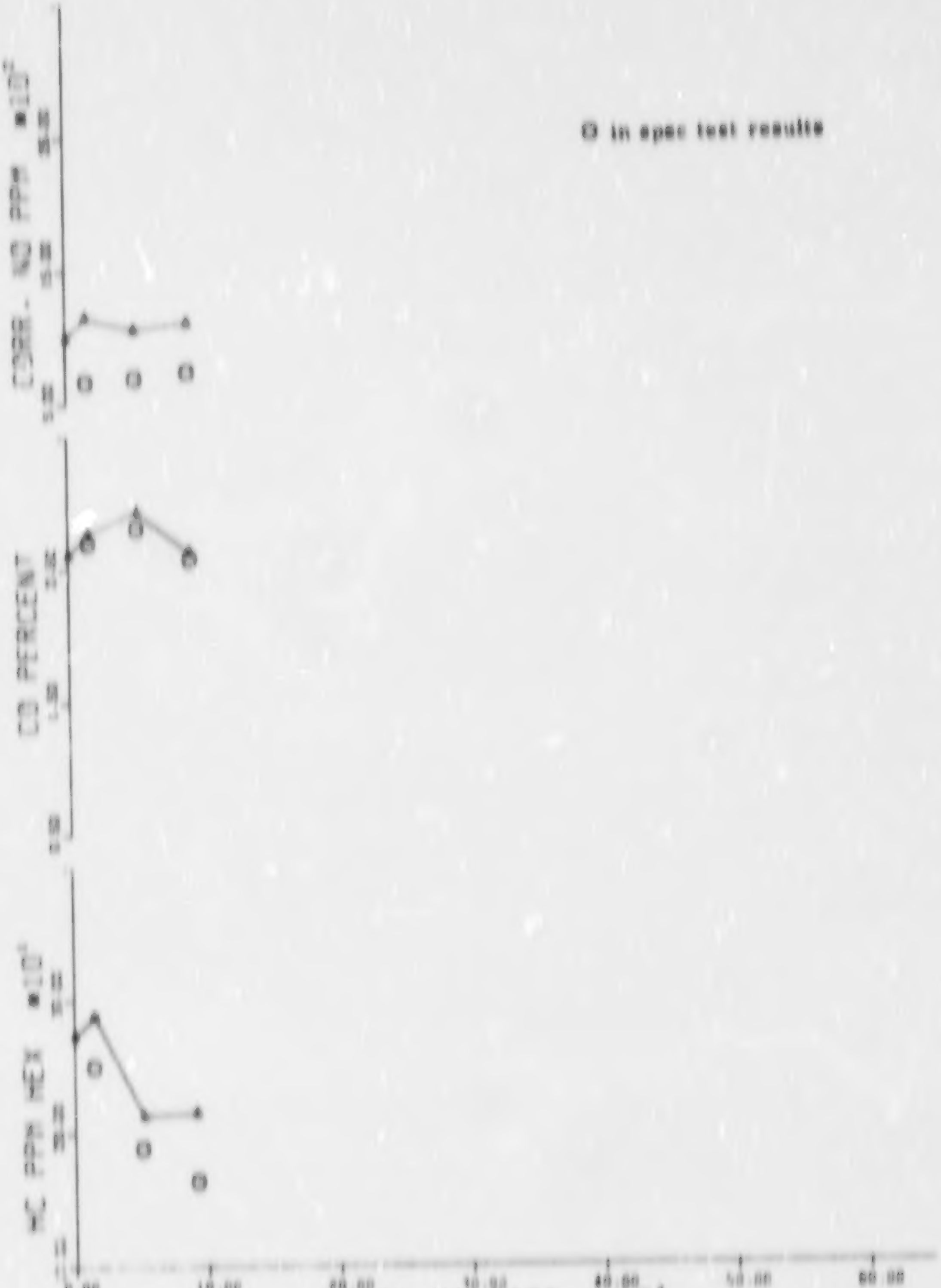
UNIT 019 73 IHC 22000 LB GVW SCHOOL BUS 345CID V8 ENGINE



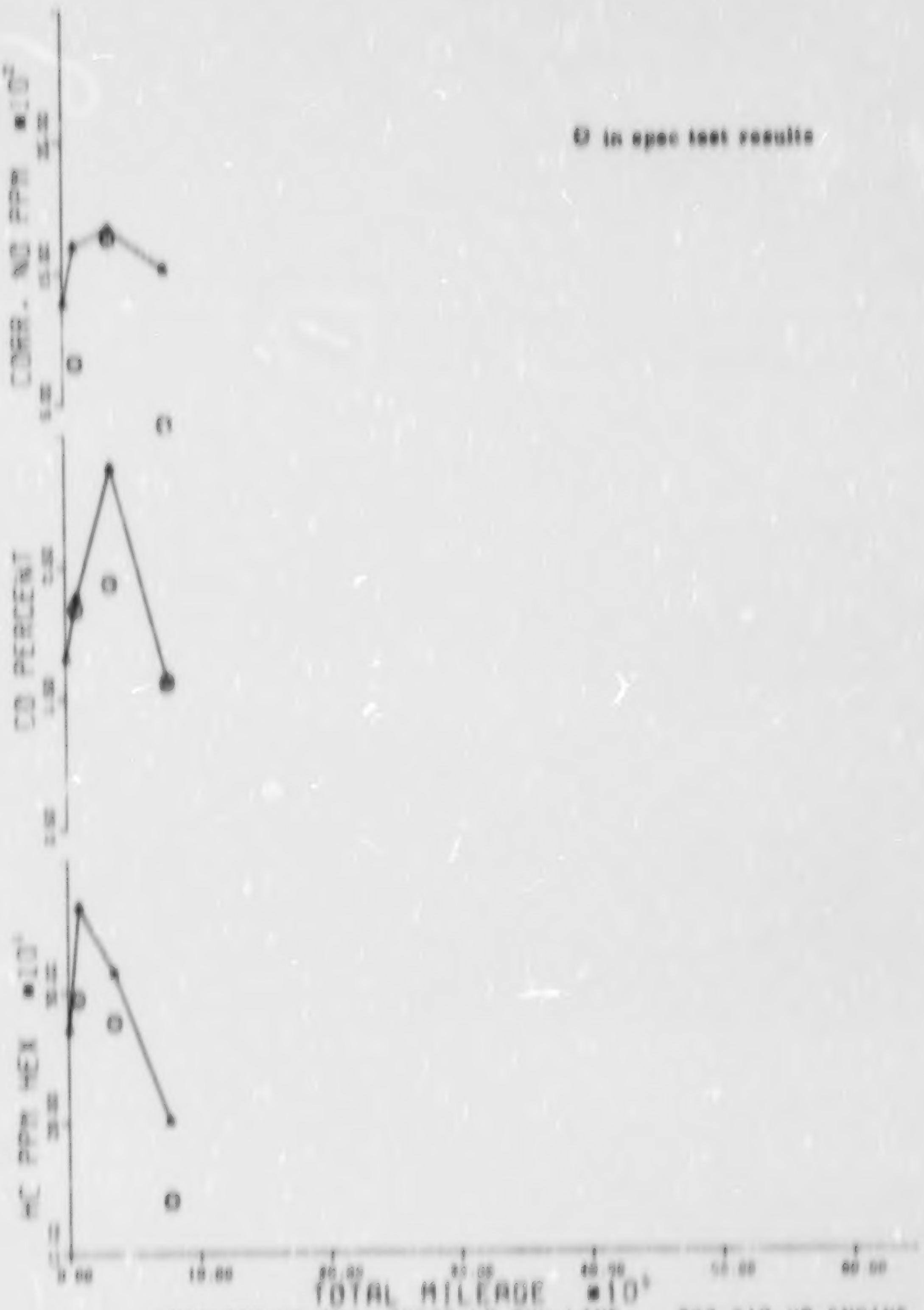
UNIT 020 73 FORD 10000 LB GVW STAKE 300 CID I6 ENGINE



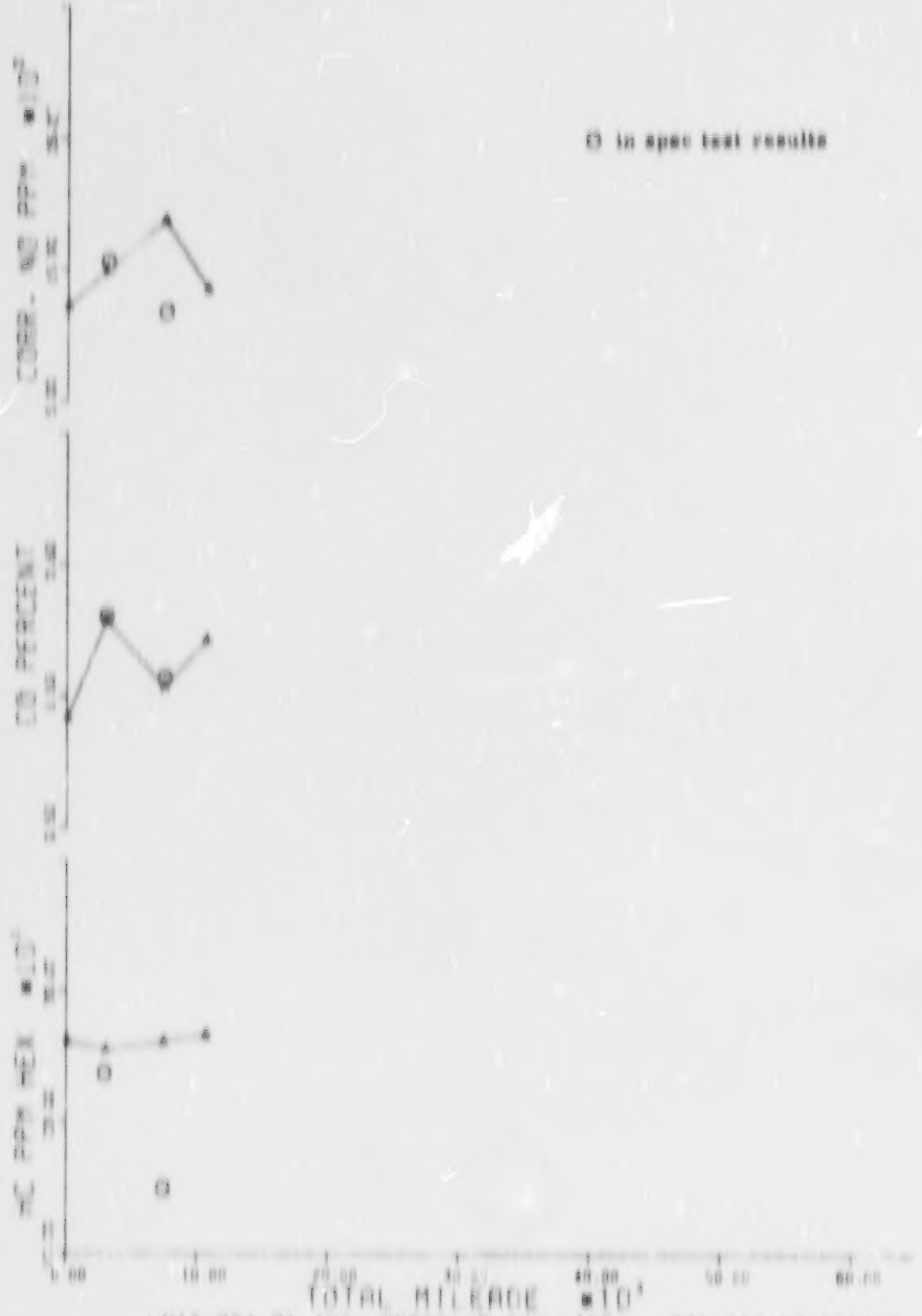
UNIT 021 70 FORD 7500 LB GVW PICKUP 240 CID I6 ENGINE



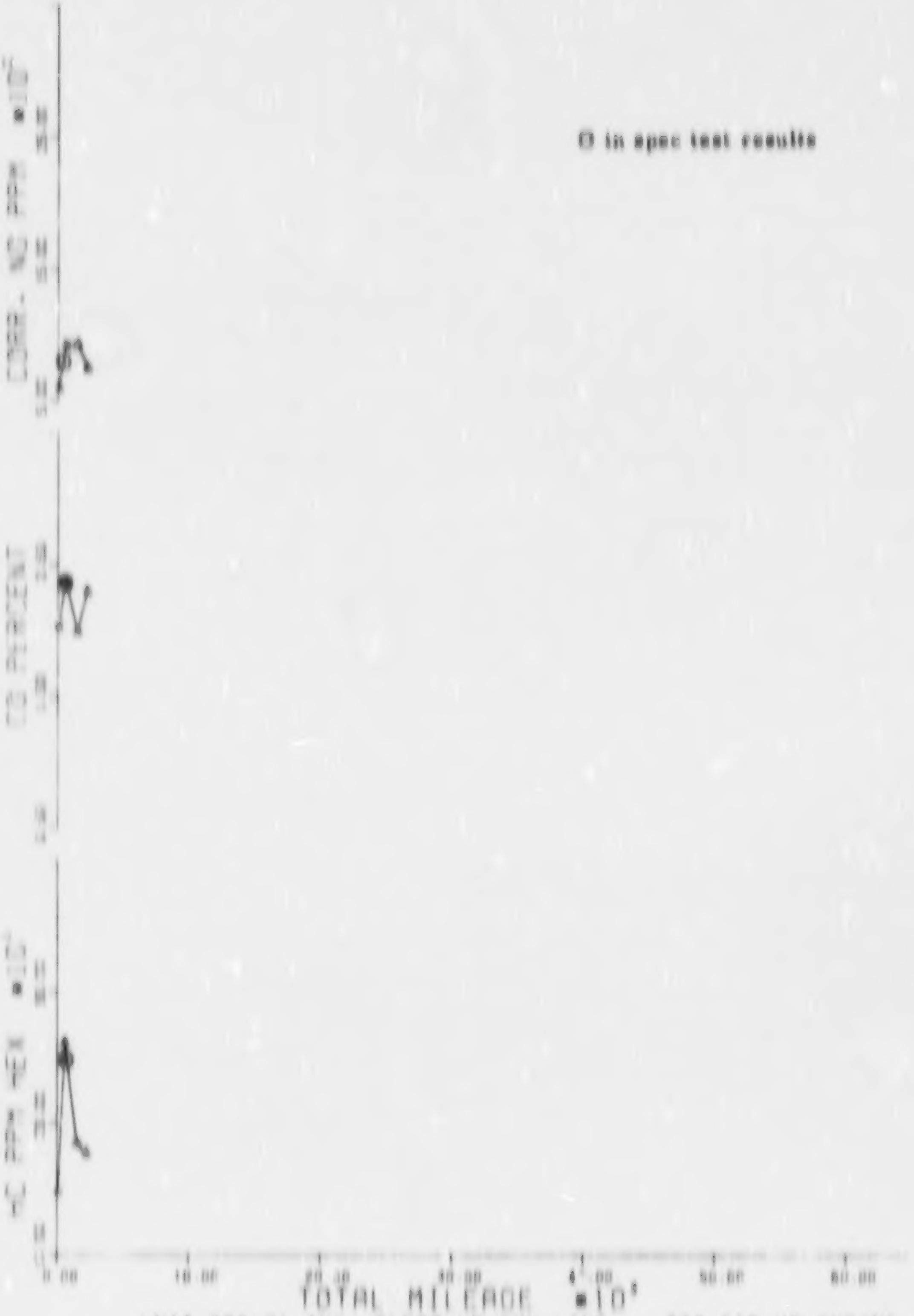
UNIT 022 71 IHC 25500 LB GVW LINE 392 CID V8 ENGINE



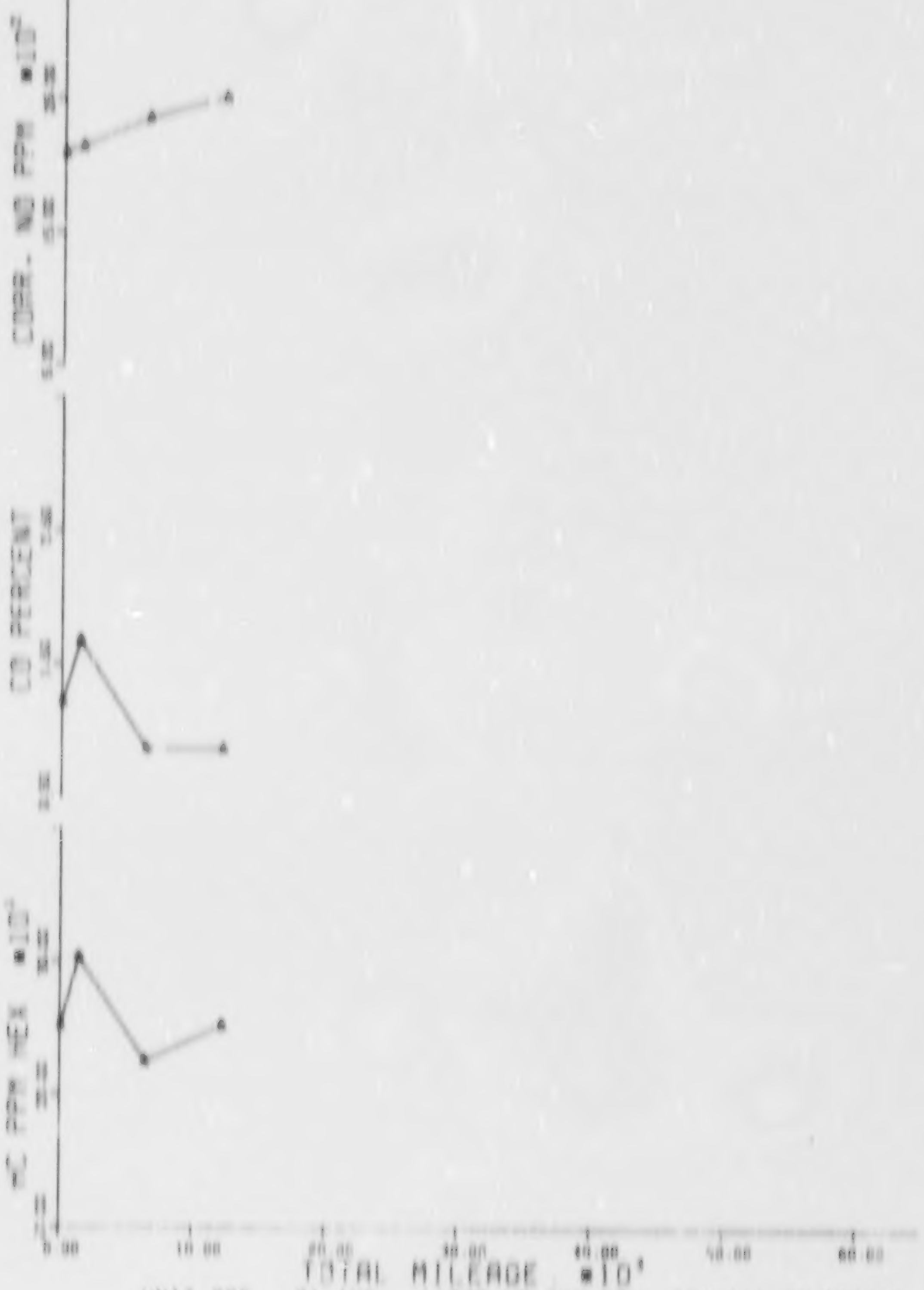
UNIT 023 70 IHC 25500 LB GVW LINE 392 CID V8 ENGINE



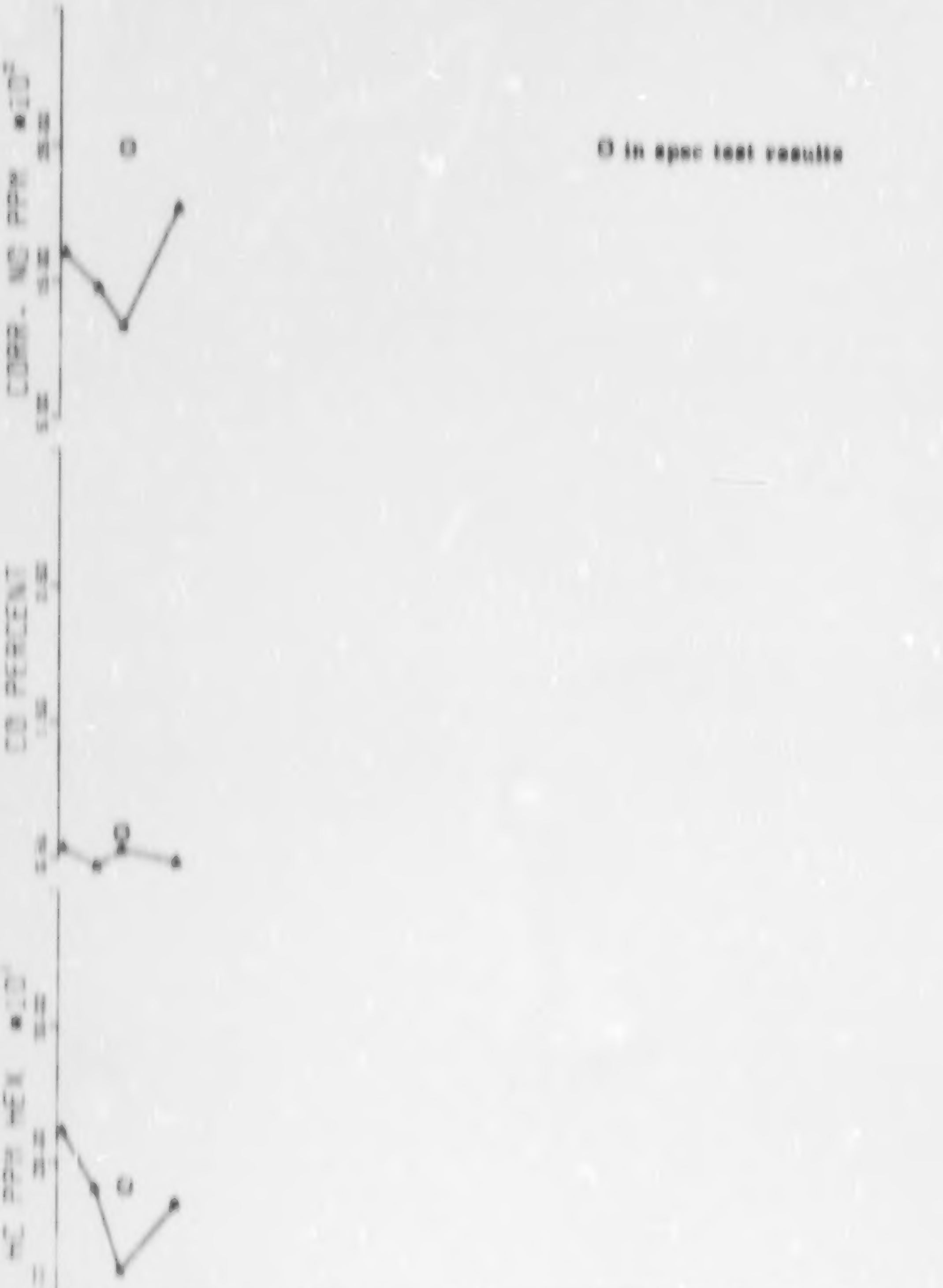
UNIT 324 71 IHC 25500 LB GVW LINE 392 CID V8 ENGINE



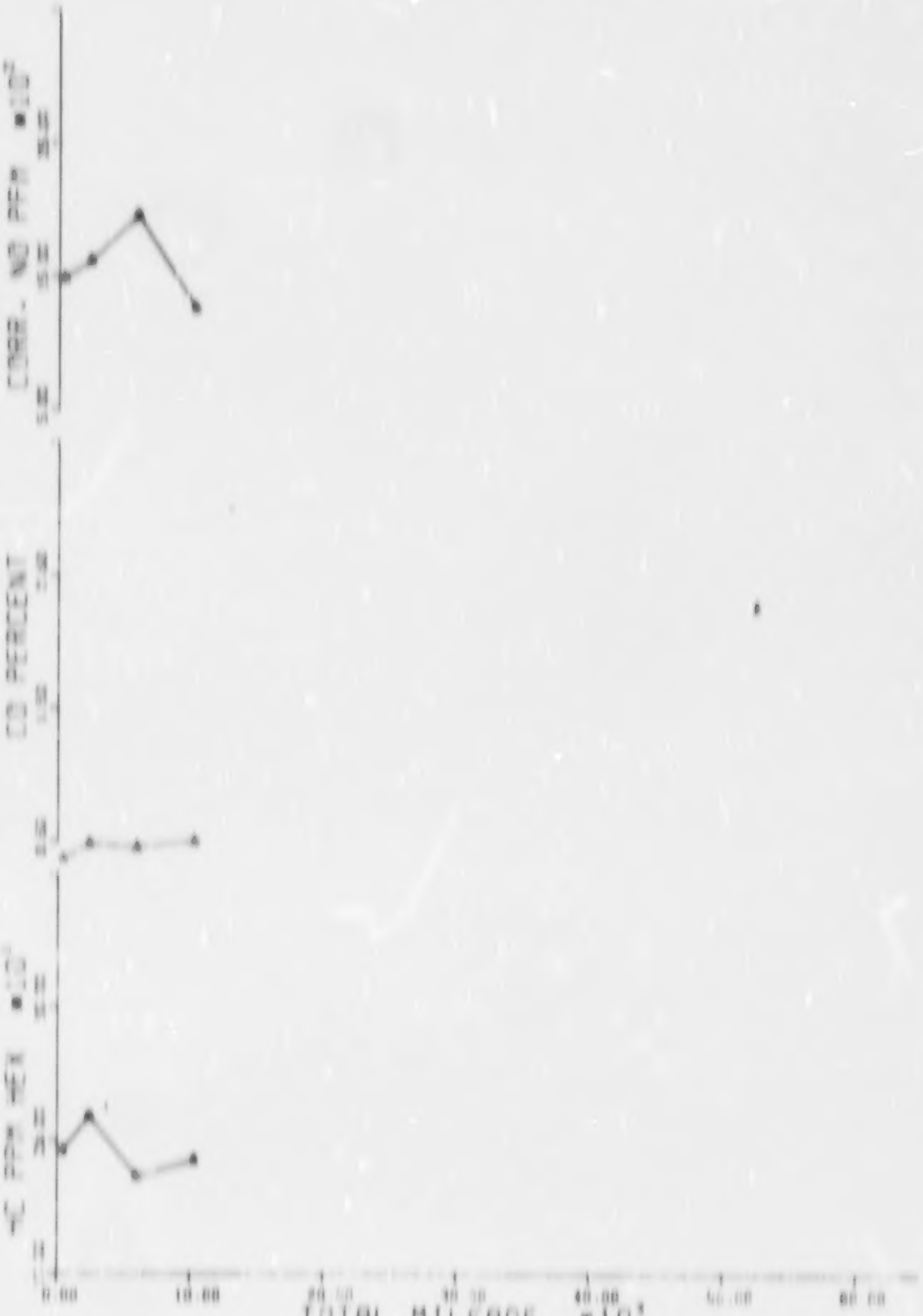
UNIT 025 71 IHC 25500 LB GVW LINE 392 CID V8 ENGINE



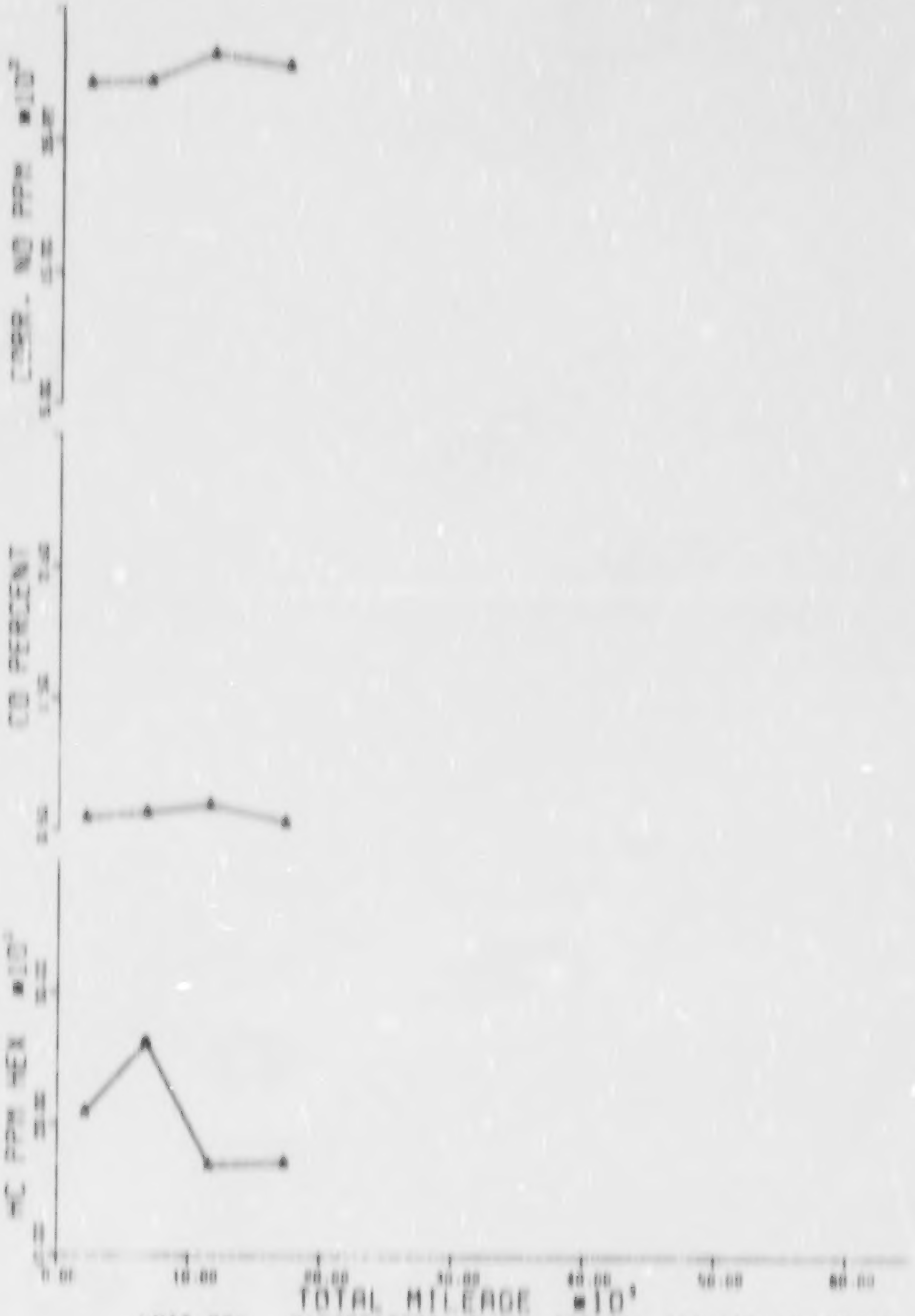
UNIT 026 71 IHC 14000 LB GVW VAN 304 CID V8 ENGINE



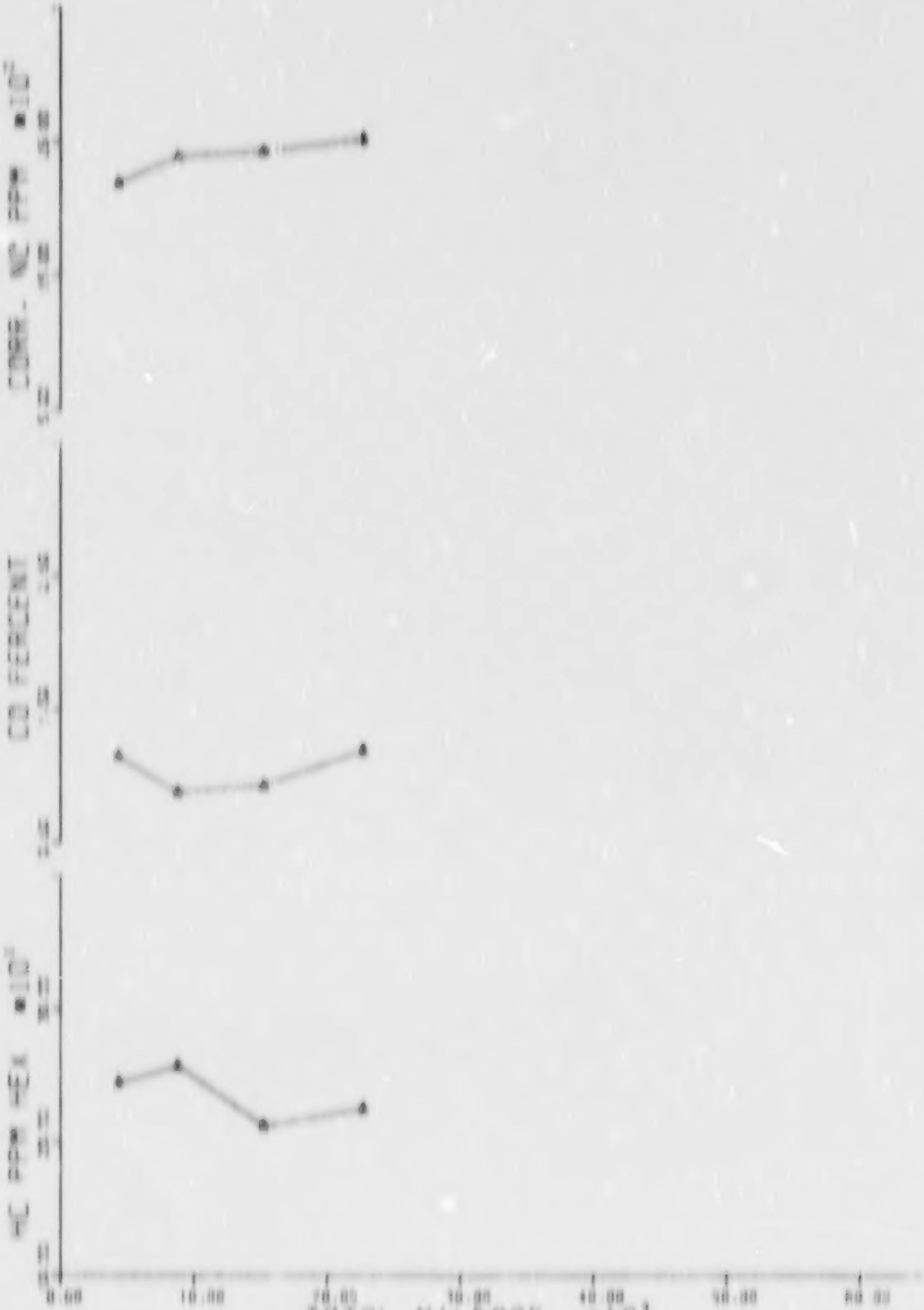
UNIT 027 71FORD10000 LB GVW SERVICE 300 CID I6 ENGINE



UNIT 028 71FORD10000 LB GVW SERVICE 390 CID V8 ENGINE

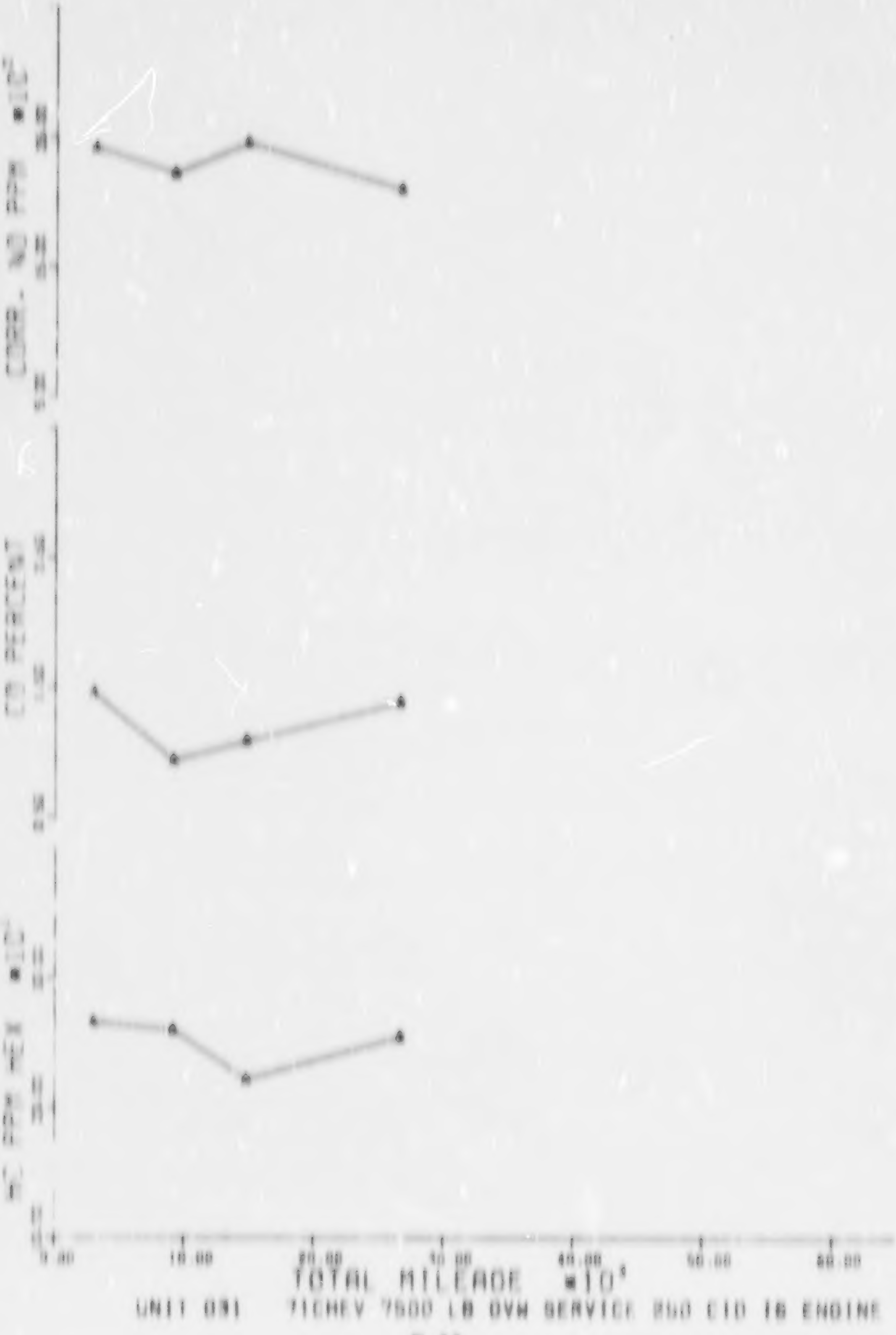


UNIT 025 71FORD16000 LB GVW SERVICE 300 CID V8 ENGINE

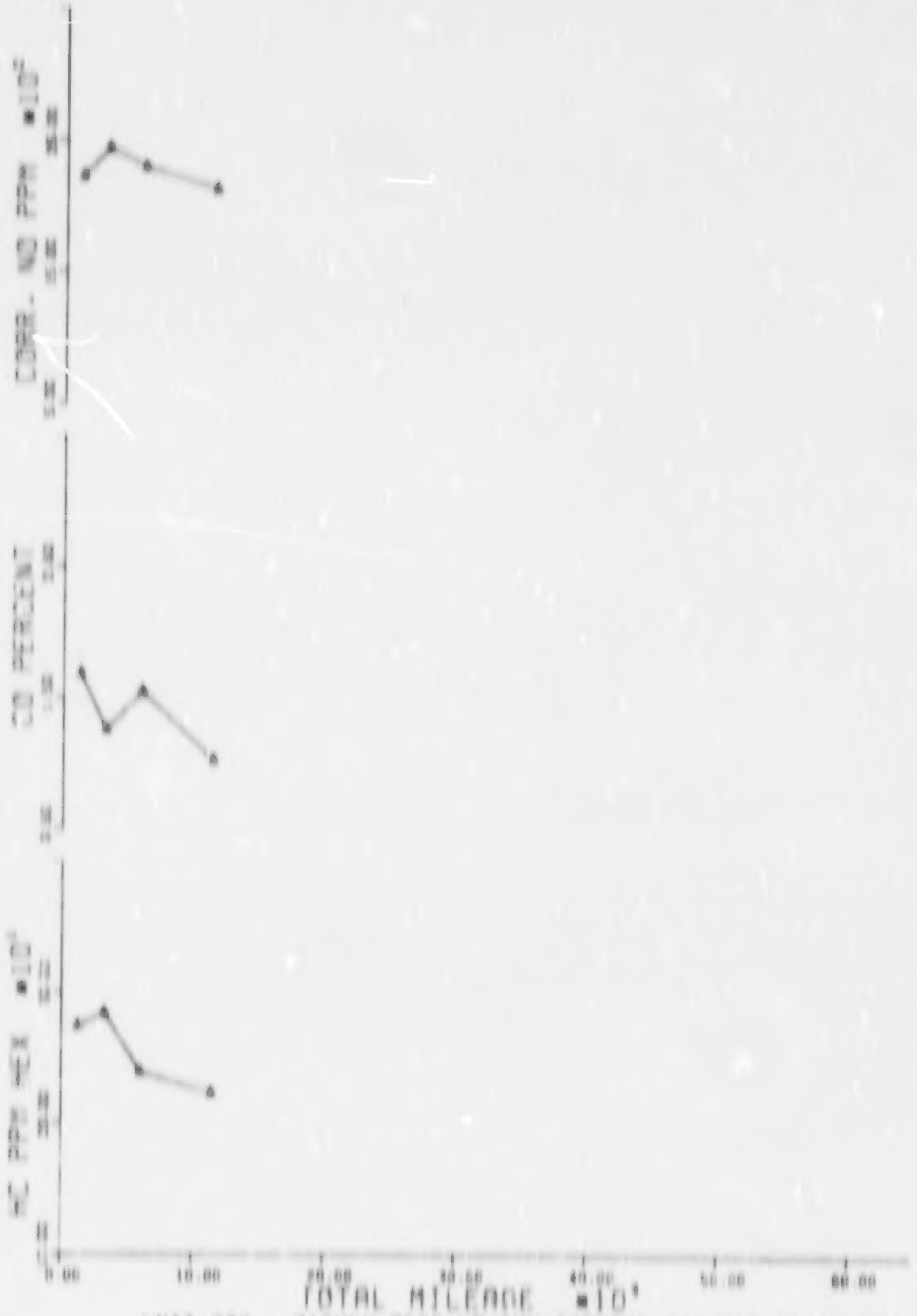


TOTAL MILEAGE *10^3

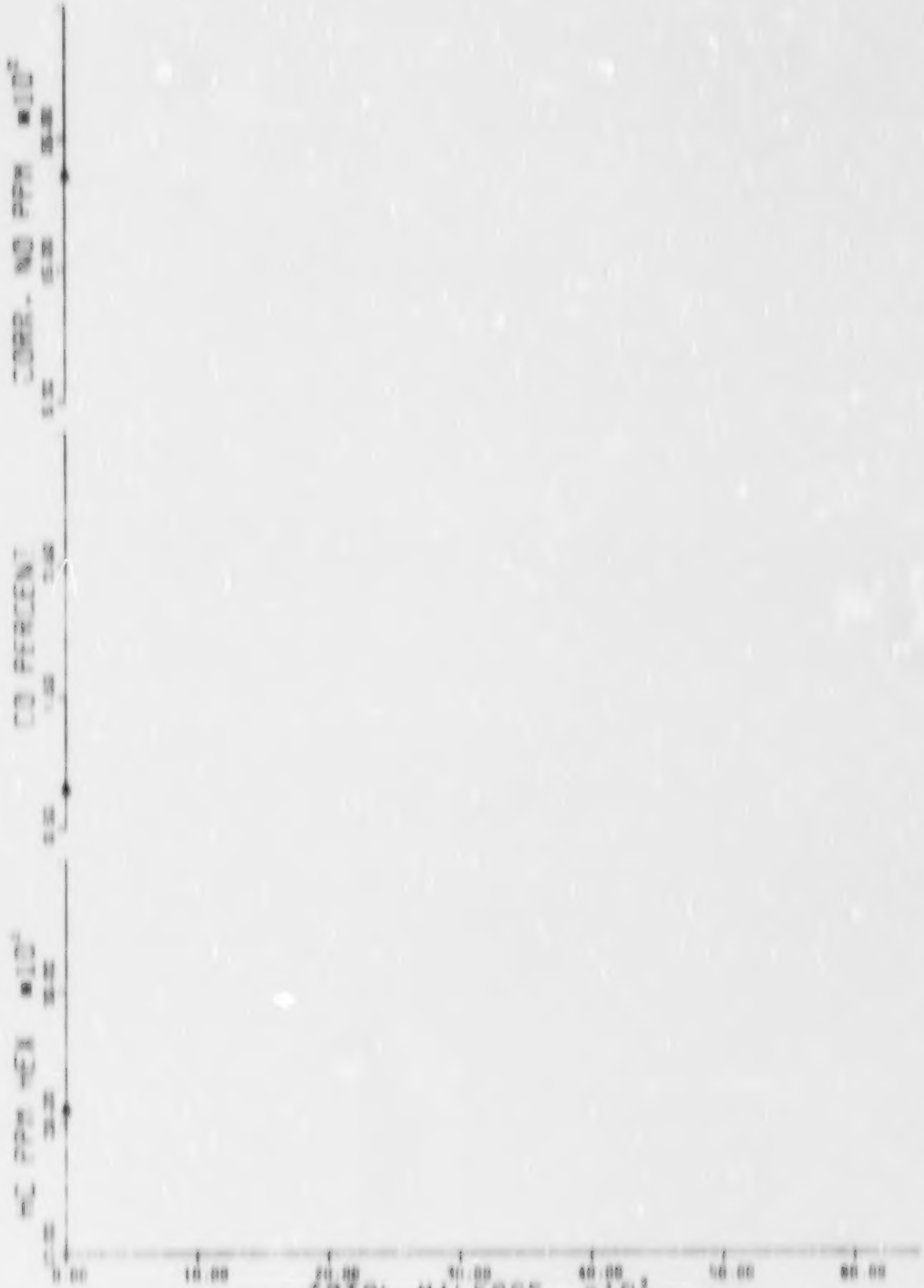
UNIT 030 71CHEV 9000 LB GVW SERVICE 292 CID 16 ENGINE



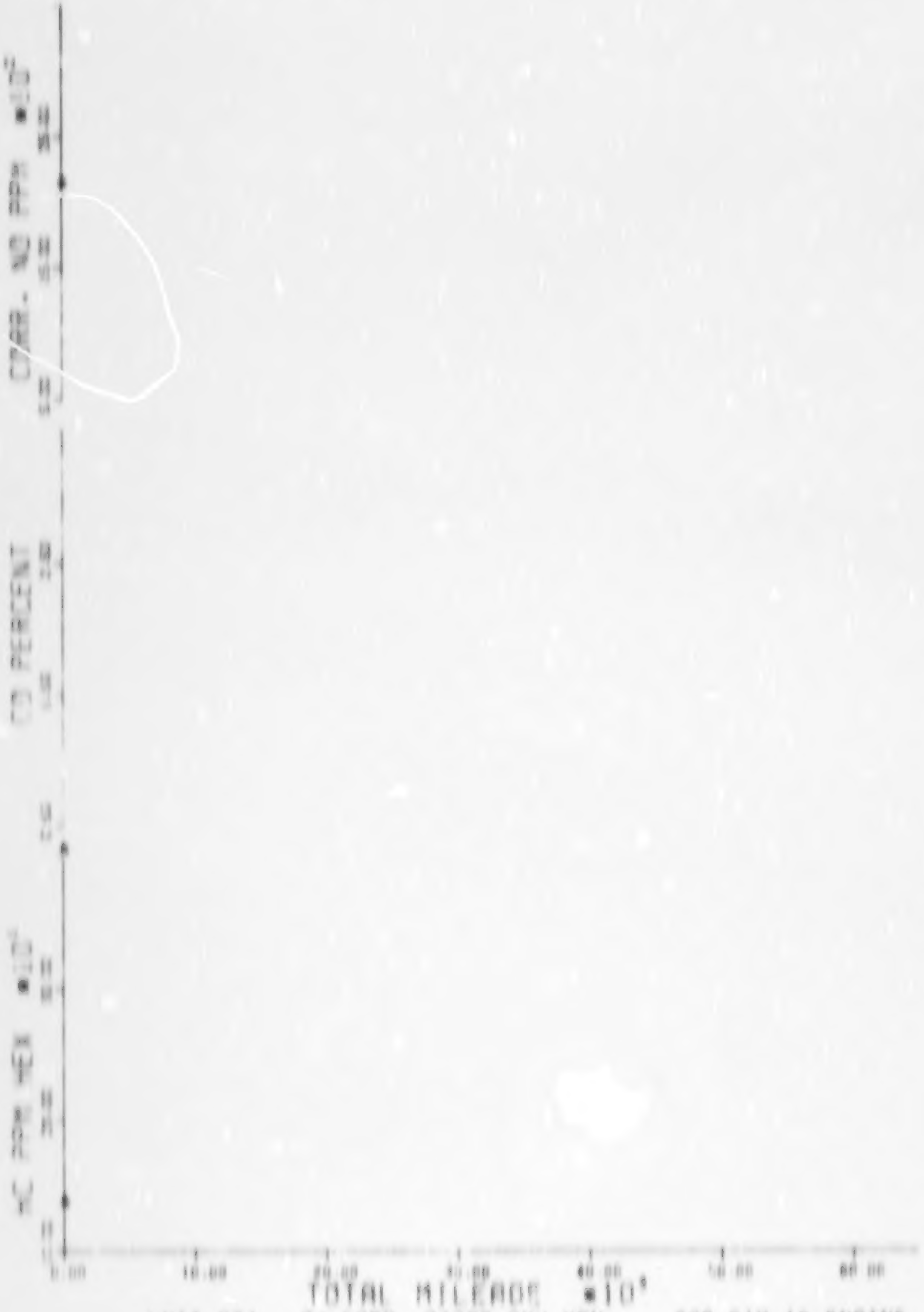
UNIT 031 71CHEV 7500 LB GVW SERVICE 250 CID L6 ENGINE



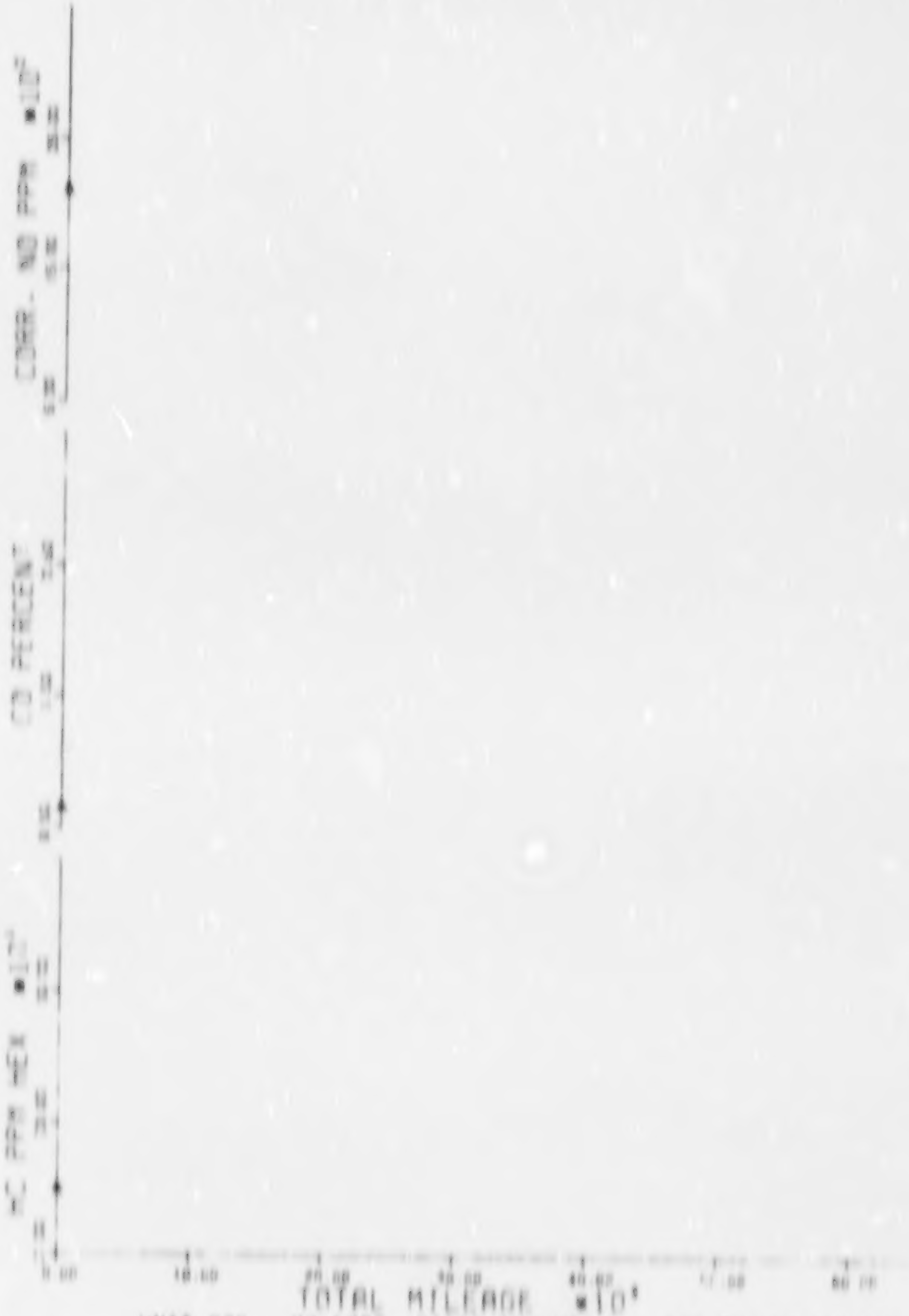
UNIT 032 71CHEV 7500 LB GVW SERVICE 250 CID I6 ENGINE



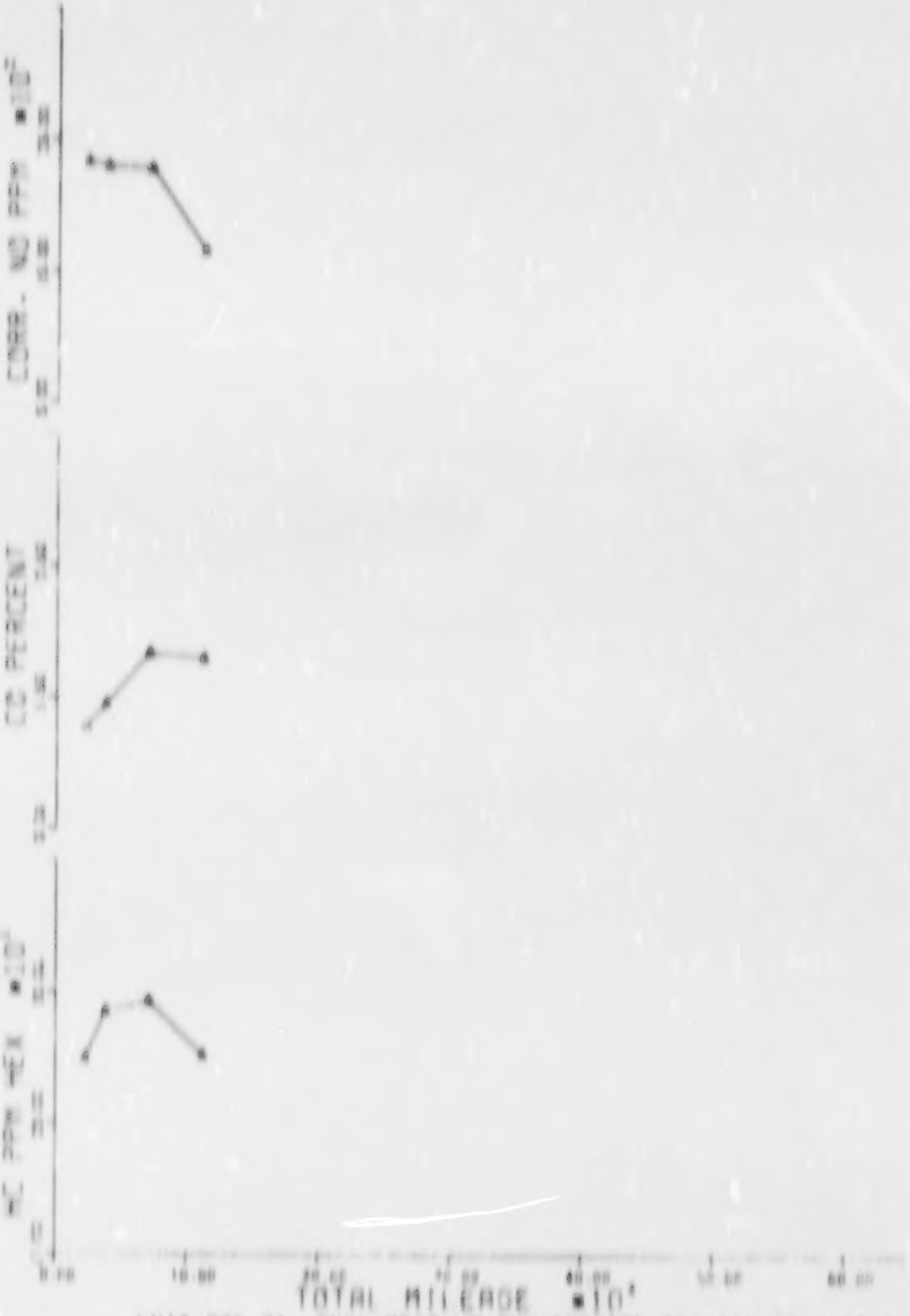
UNIT 033 70 FORD 24000 GVW VAN 300 CID I6 ENGINE



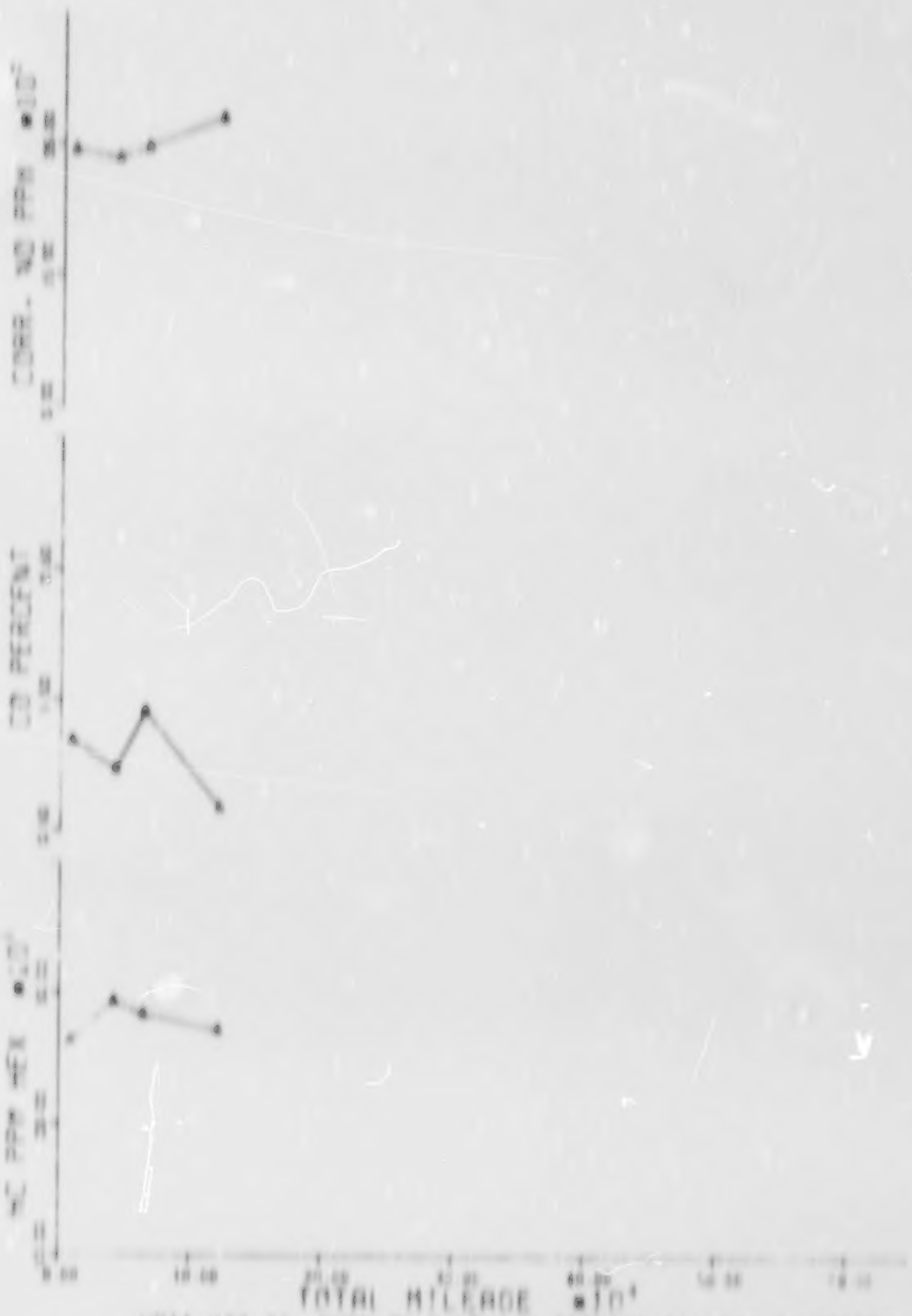
UNIT 034   70 FORD 24000 GVW VAN   300 CID I6 ENGINE



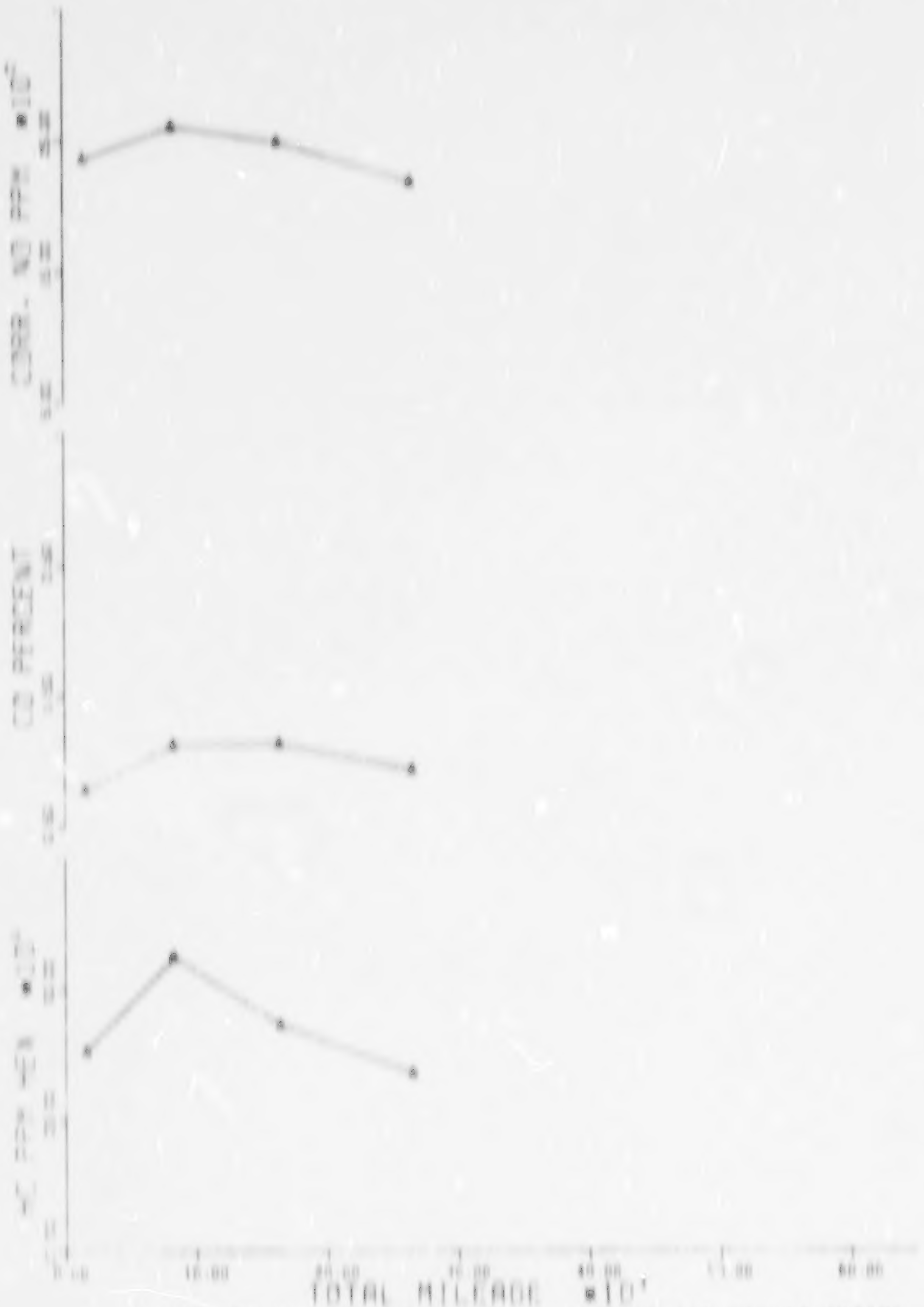
UNIT 035 73 FORD 24000 GVW VAN 300 CID I6 ENGINE



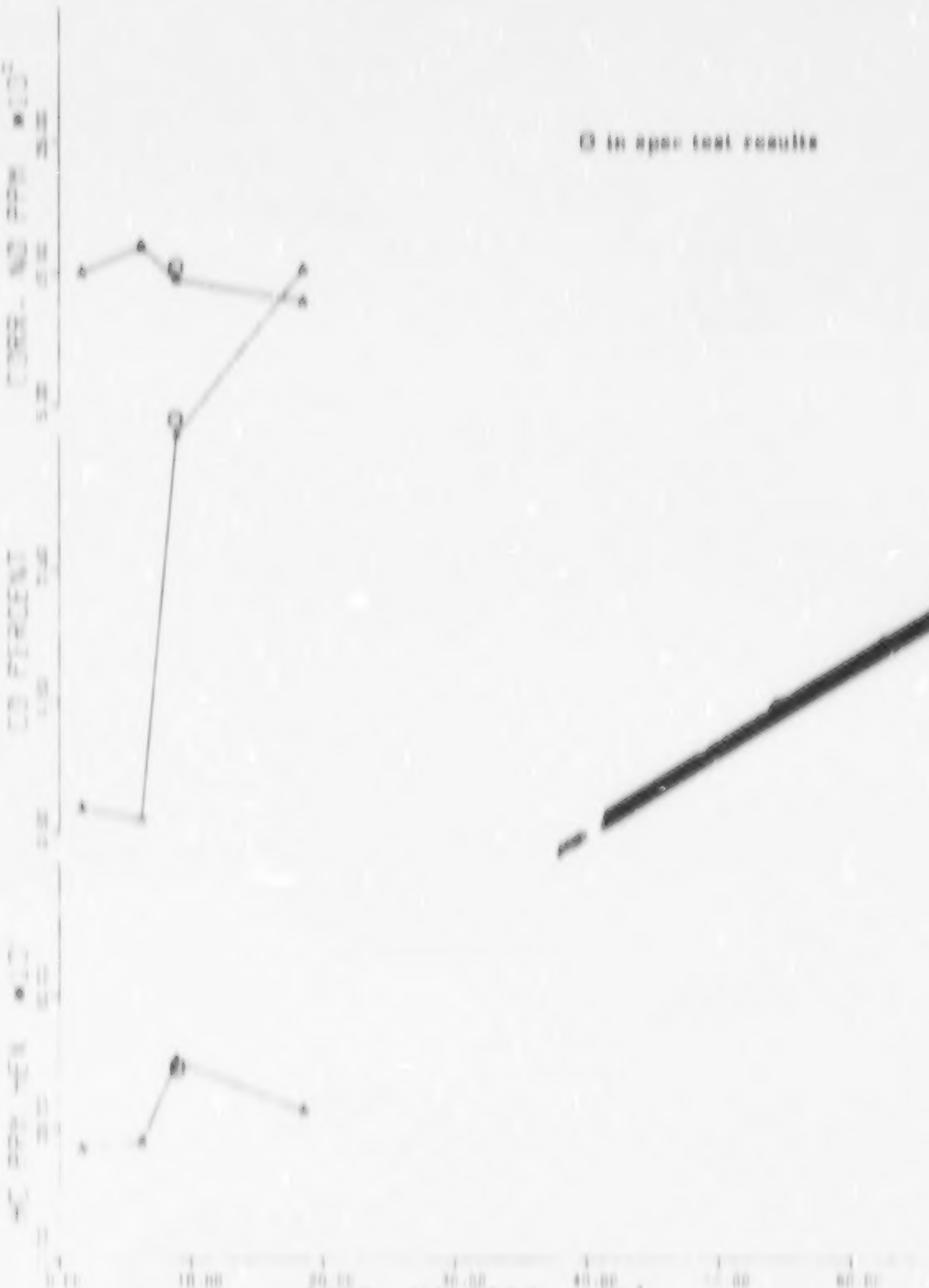
UNIT 036 71 CHEV 7500 LB GVW SERVICE 250 CID 16 ENGINE



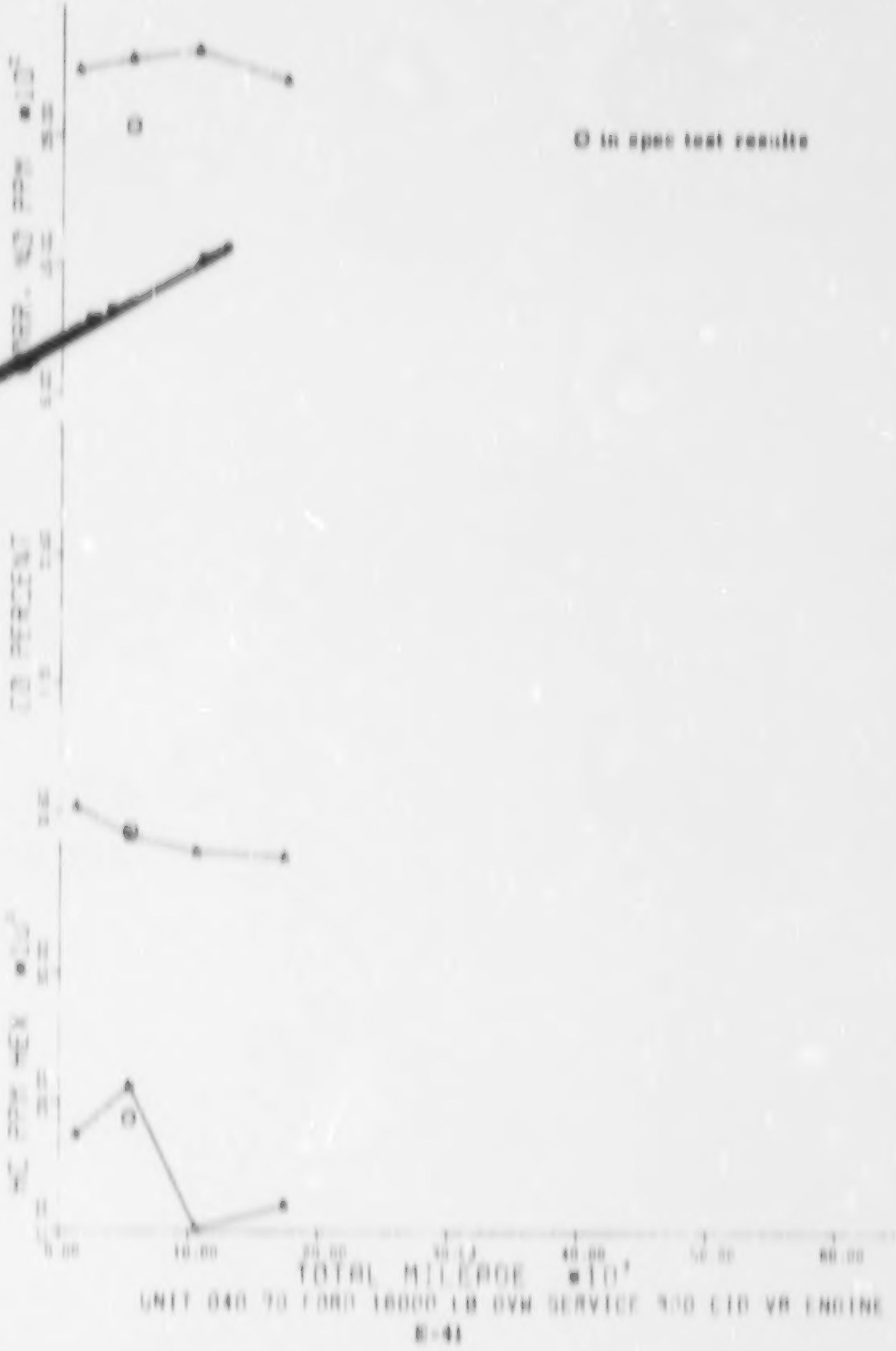
UNIT 037 TO CHEV 7630 LB GVW SERVICE 250 CID I6 ENGINE



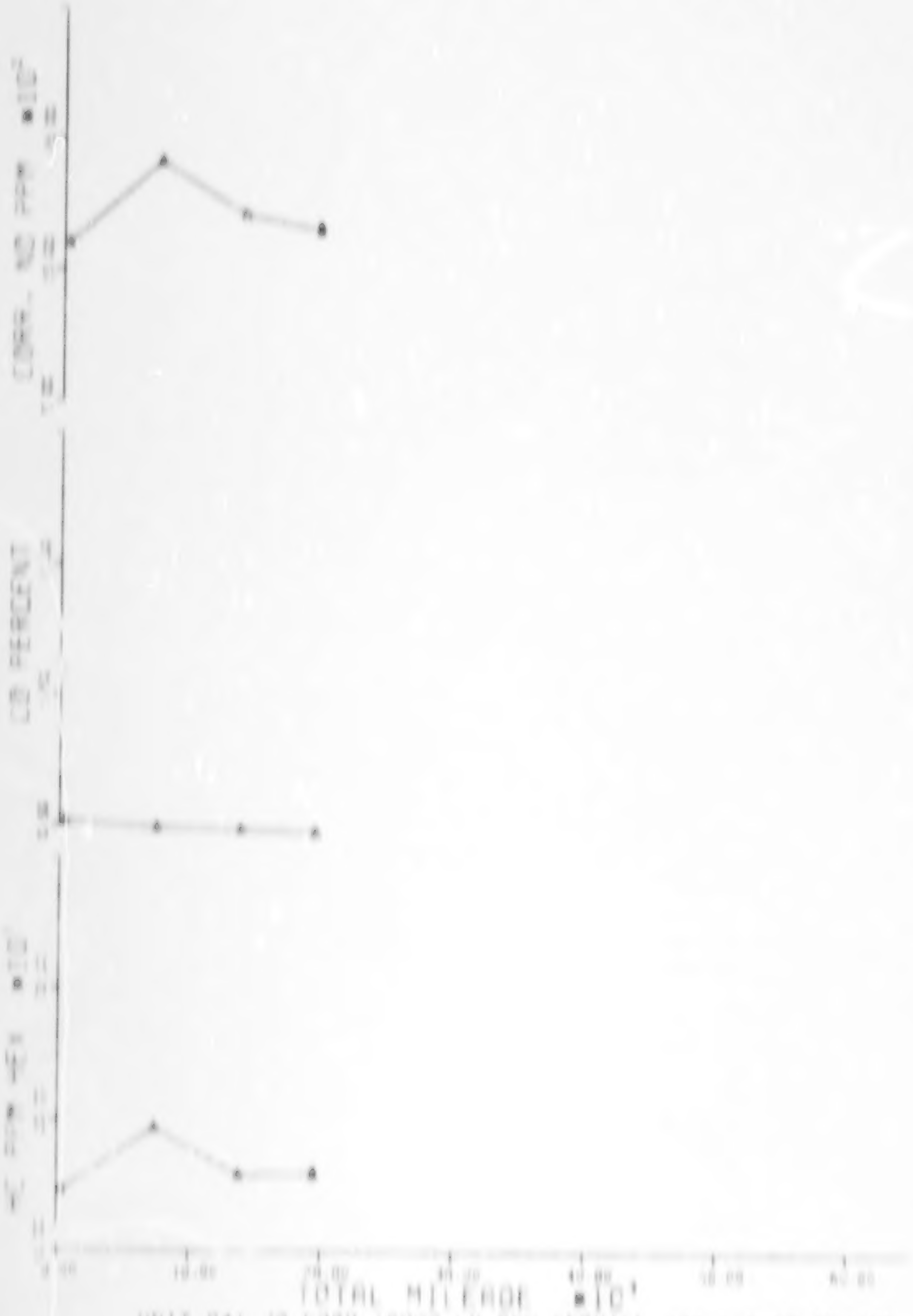
UNIT 038 70 IHC14000 LB GVW SERVICE 304 CID V8 ENGINE



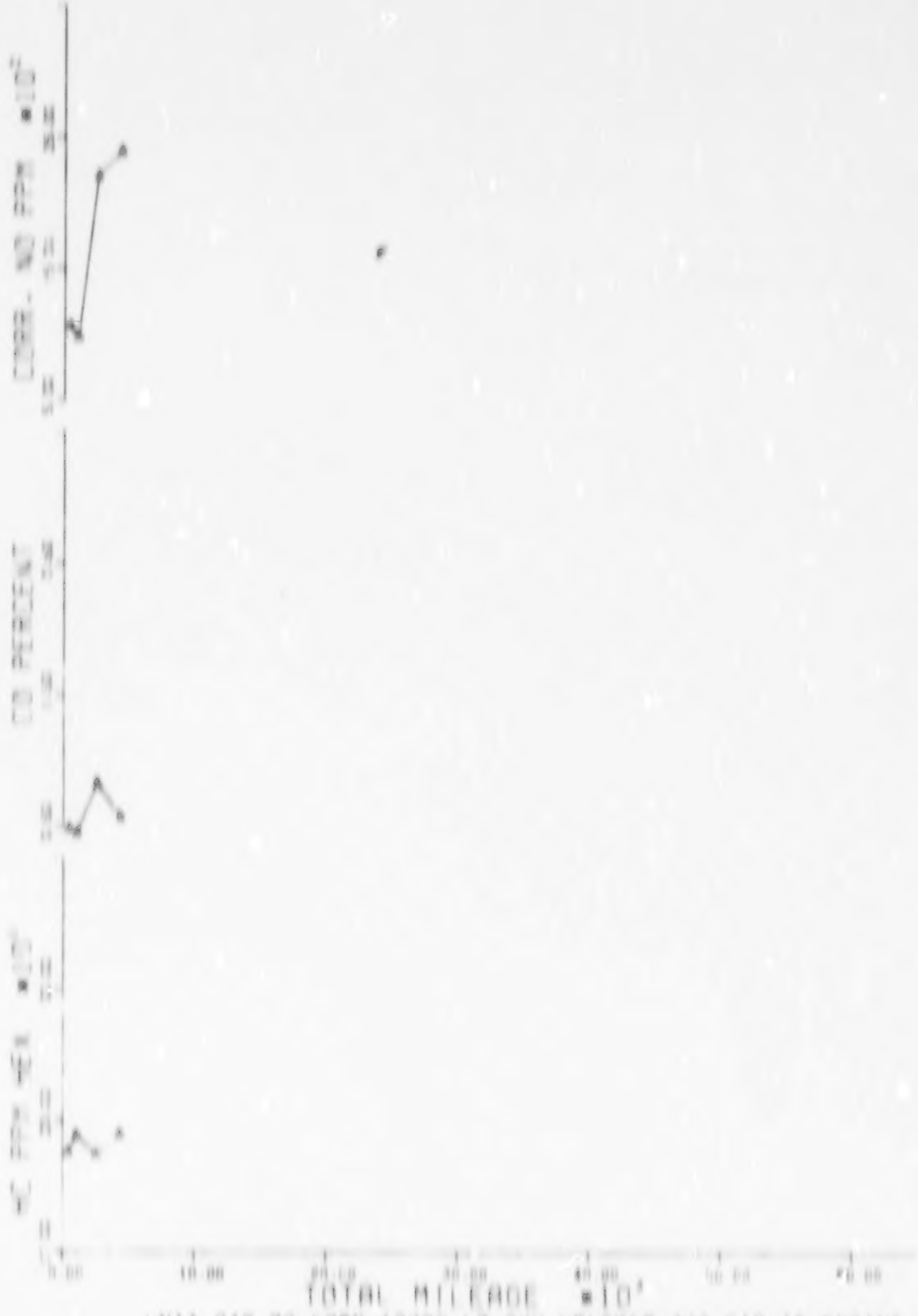
UNIT 039 70 FORD 18000 LB GVW SERVICE 300 CID V8 ENGINE



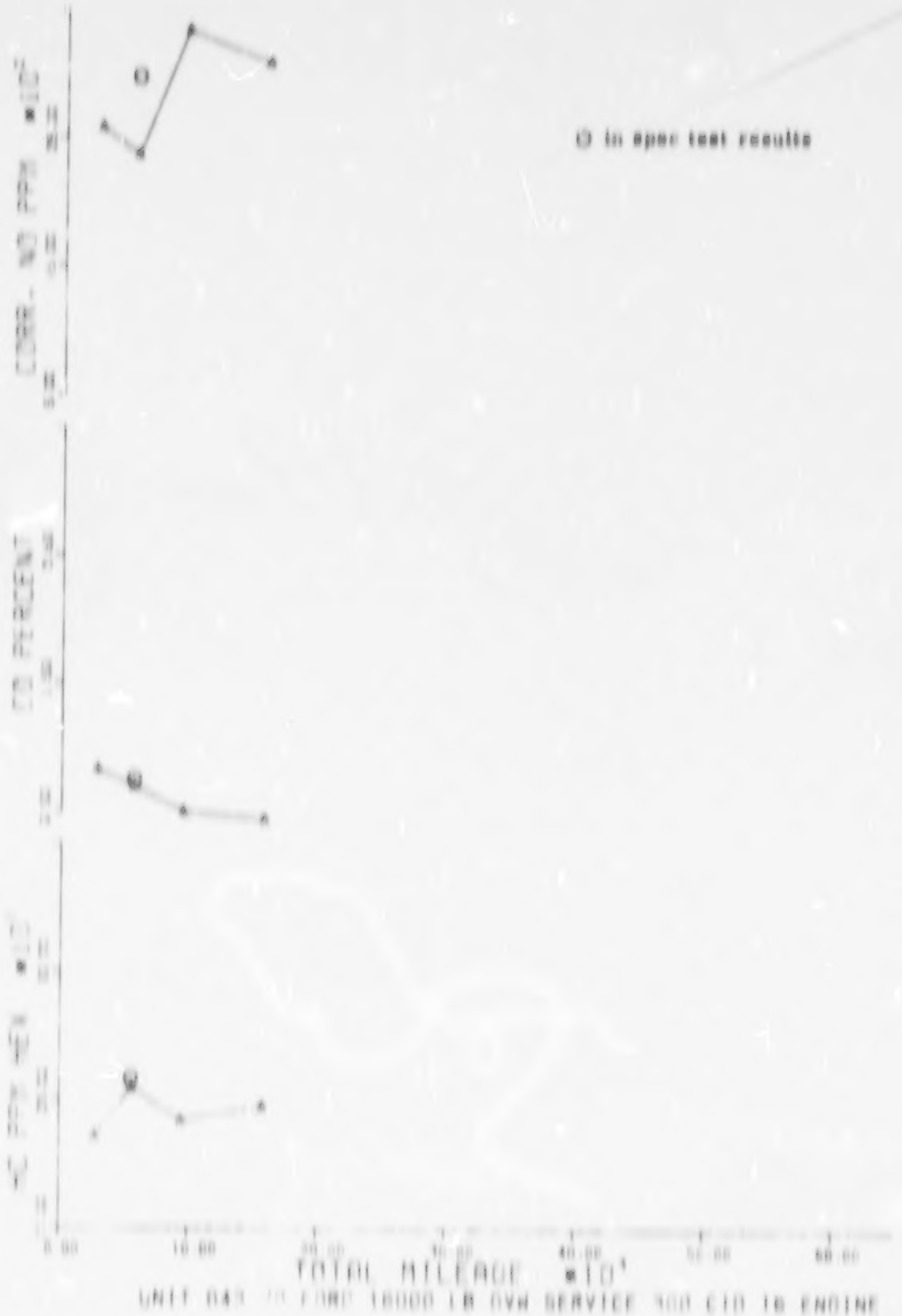
UNIT 040 70 FORD 18000 LB GVW SERVICE 330 CID V8 ENGINE



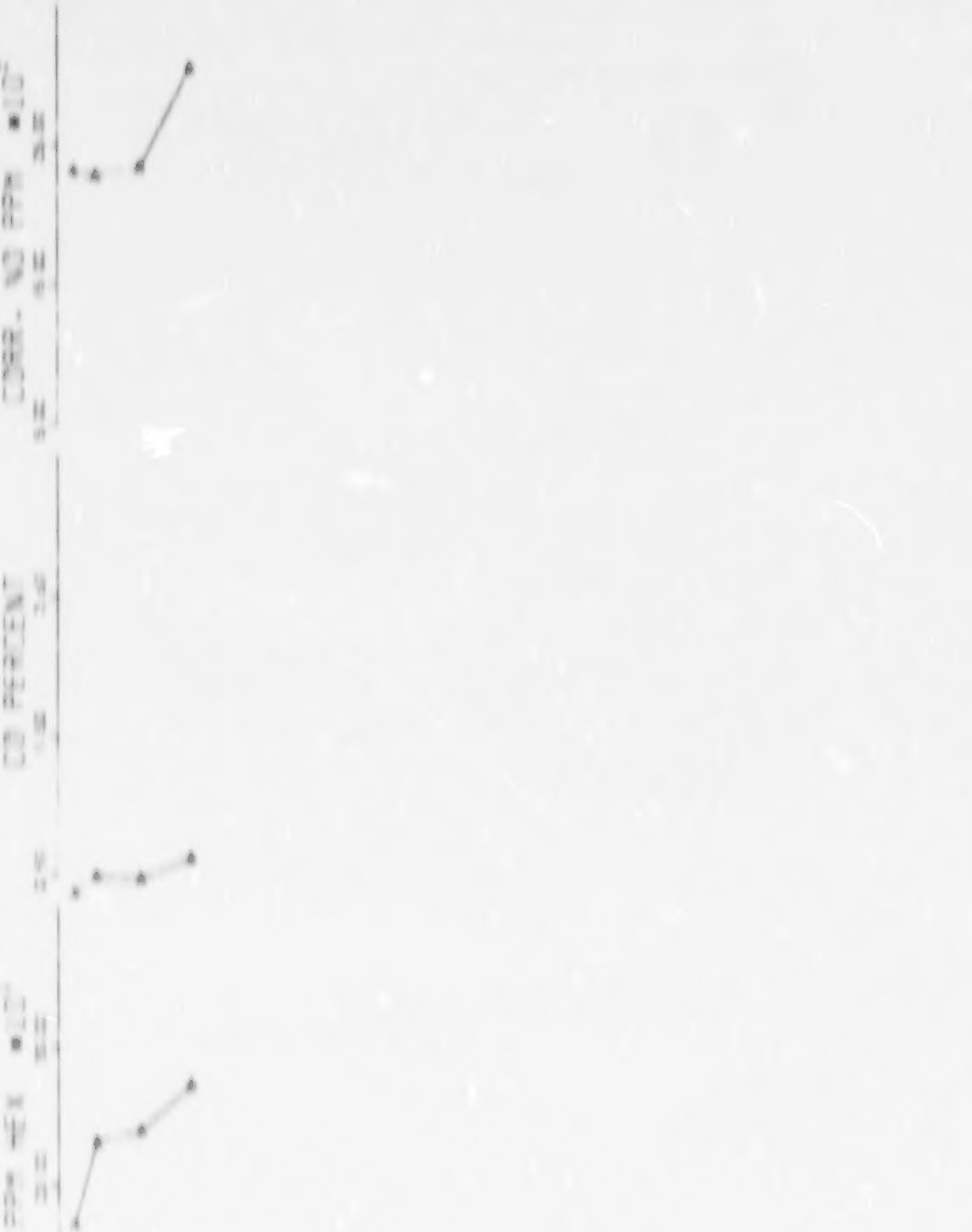
UNIT 041 70 FORD 16000 LB GVW SERVICE 300 CID V8 ENGINE



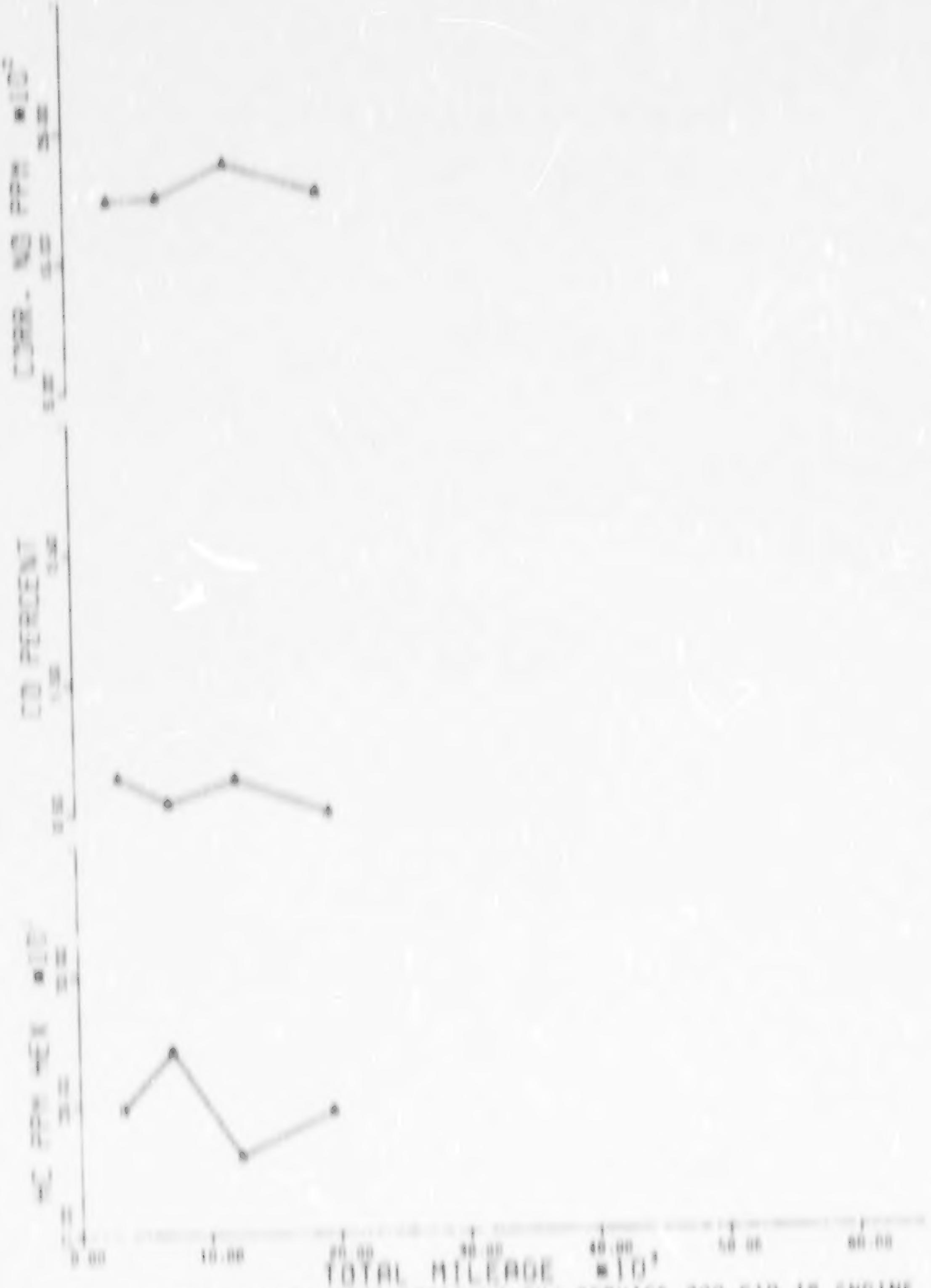
UNIT 042 70 FORD 10000 LB GVW WRECKER 330 CID V8 ENGINE



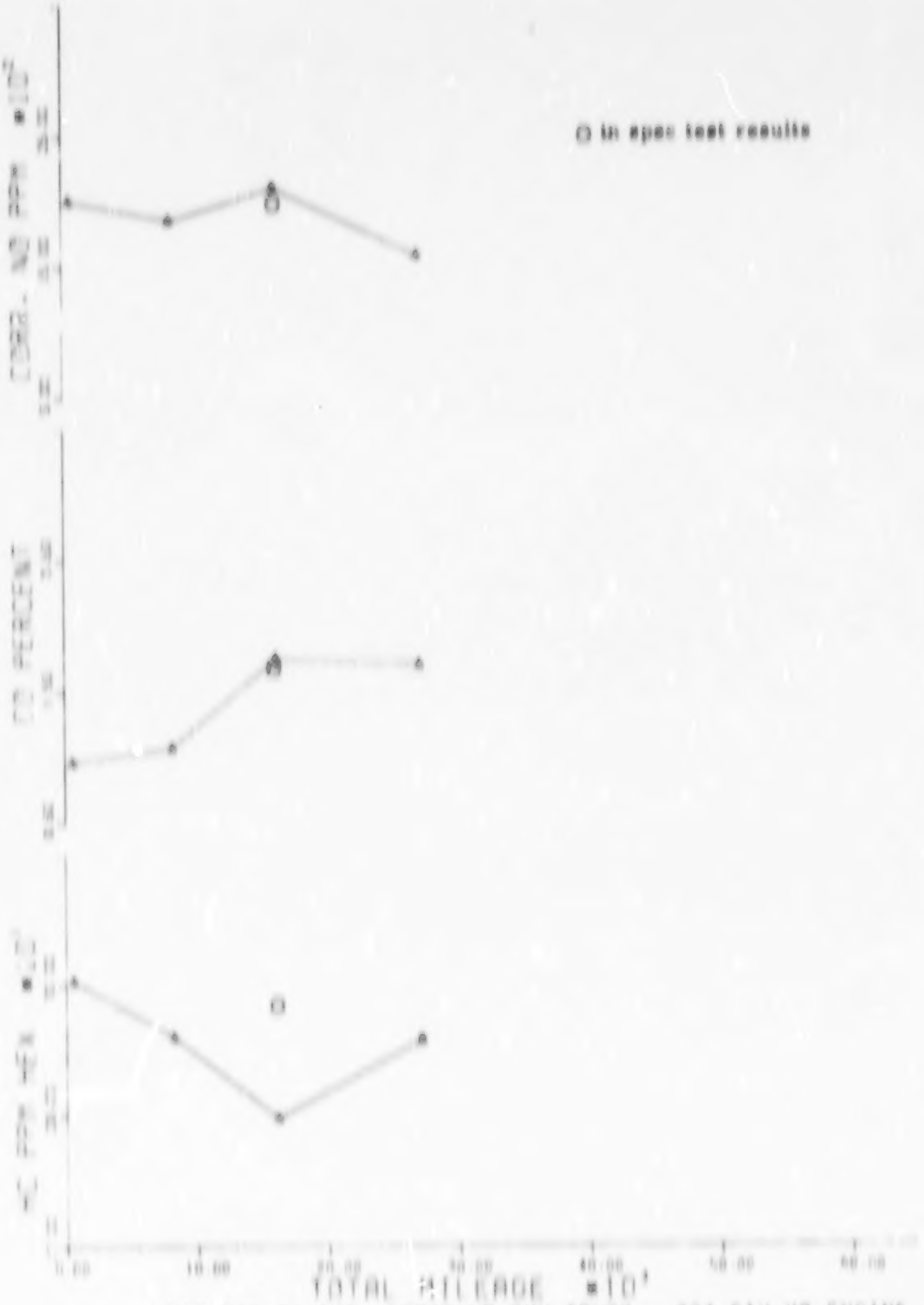
UNIT 043 70 FORD 16000 LB GVW SERVICE 300 CID I6 ENGINE



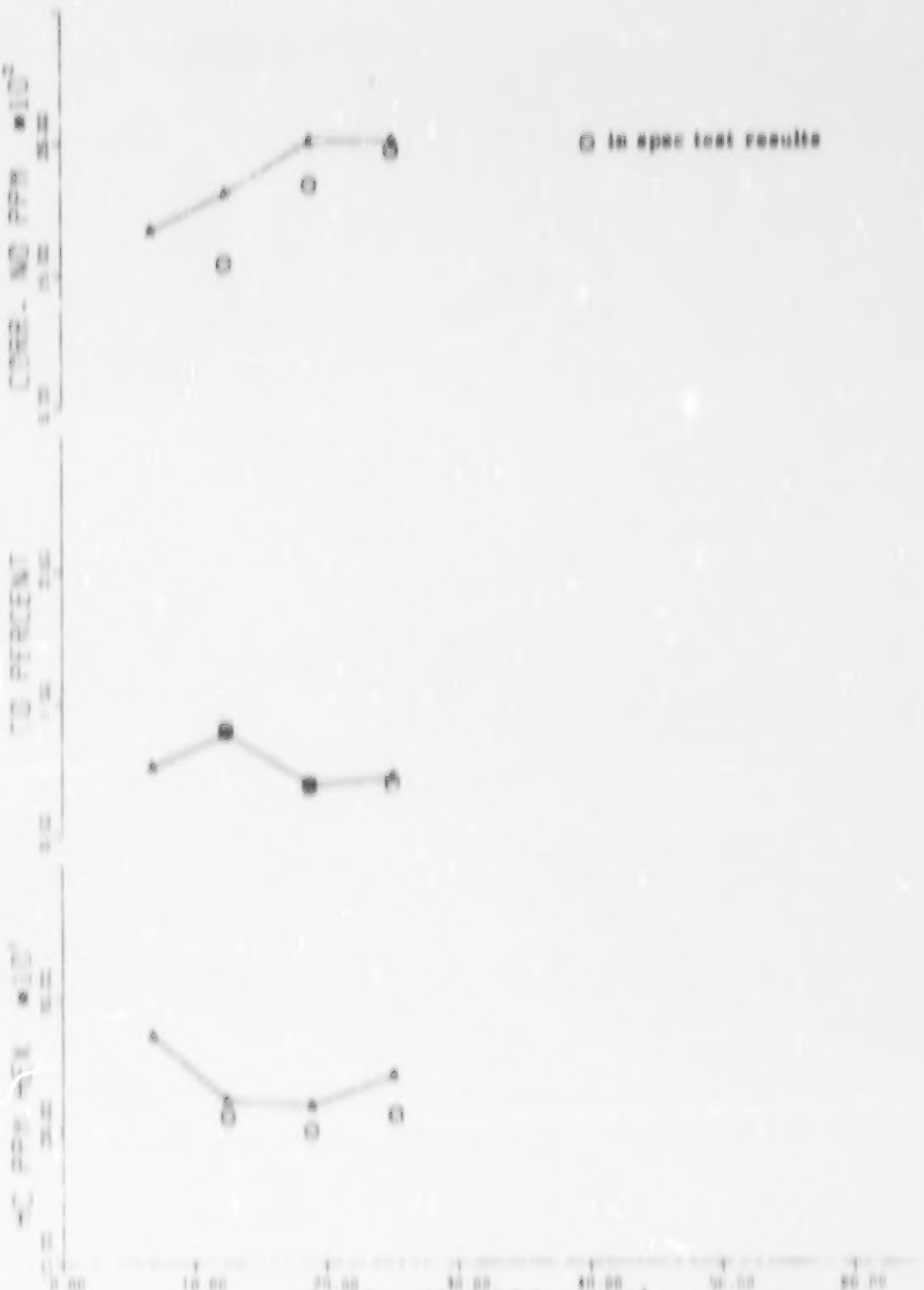
UNIT 044 73 FORD 10000 LB GVW STAKE 300 CID I6 ENGINE



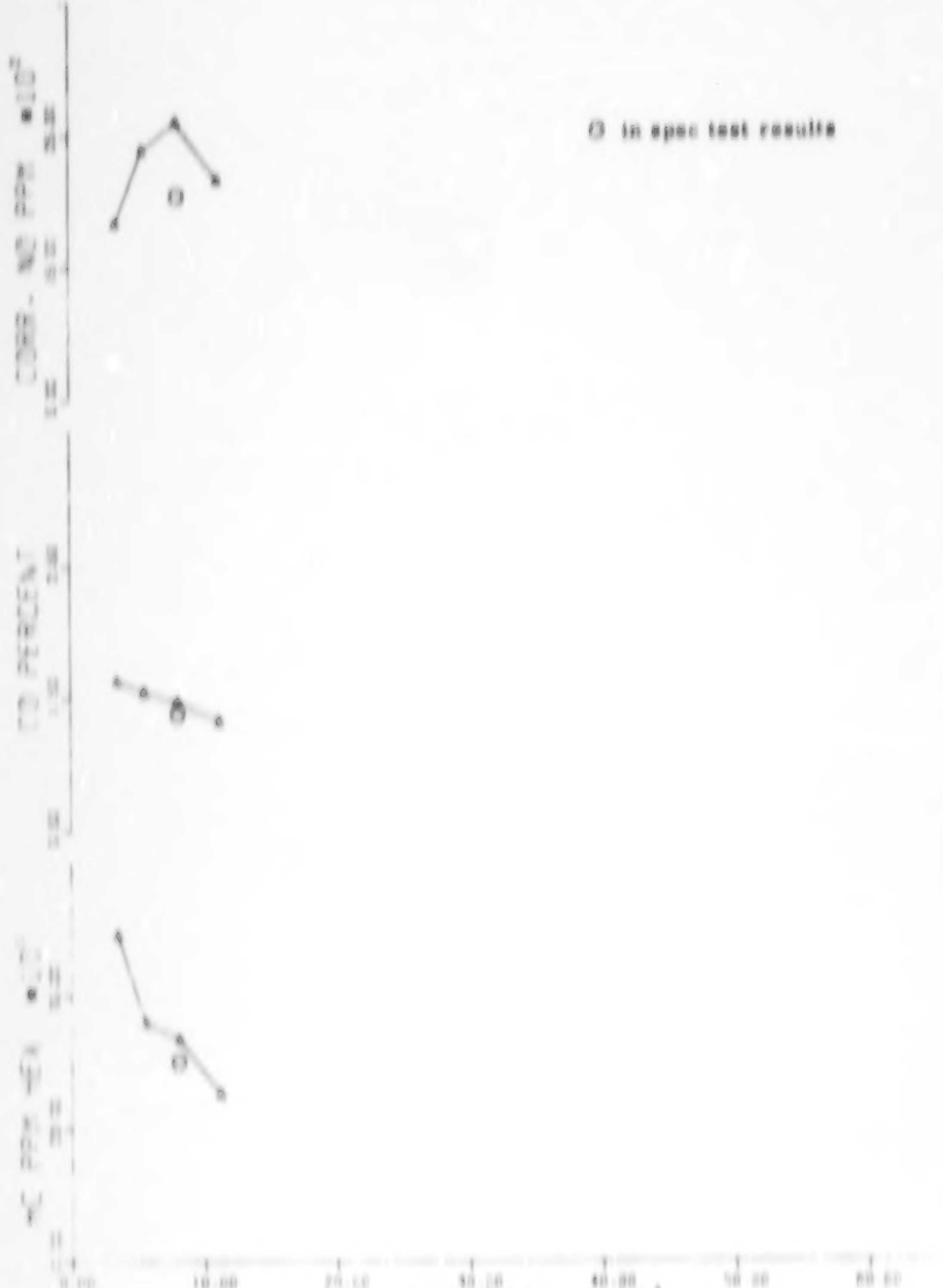
UNIT 045 70 FORD 18000 LB GVW SERVICE 300 CID I6 ENGINE



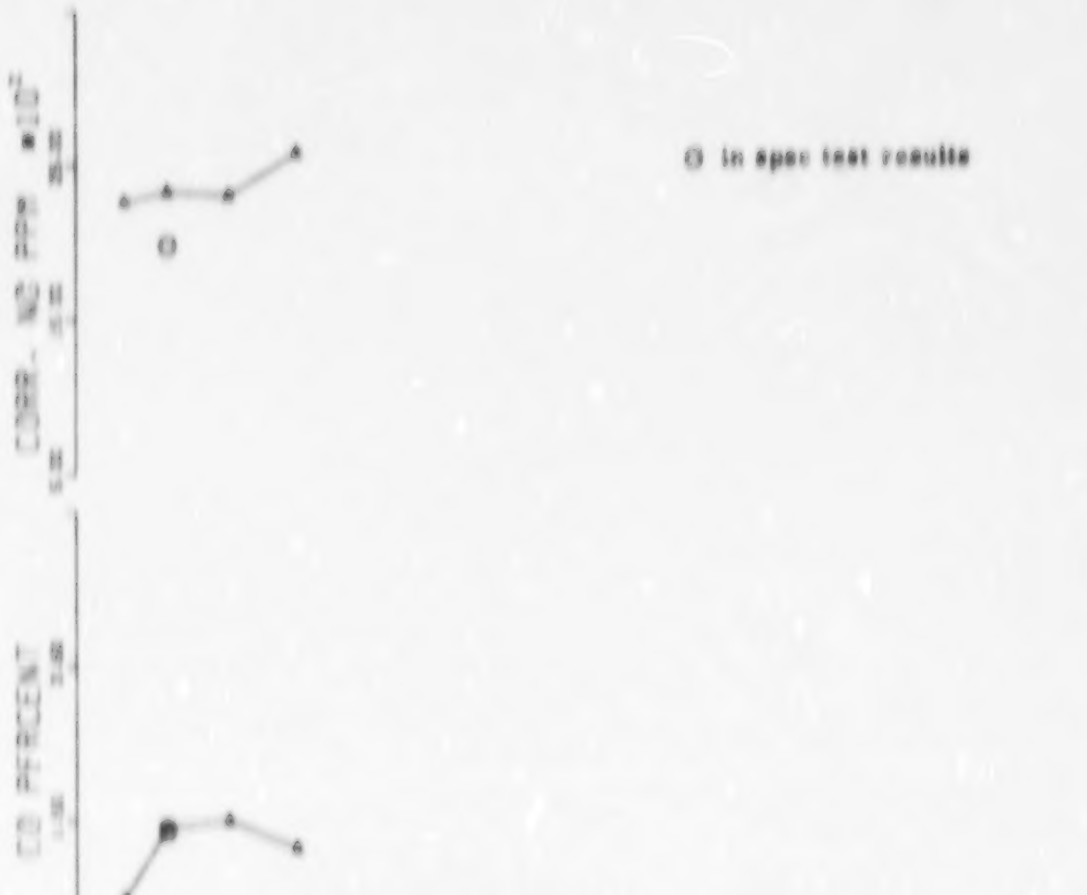
UNIT 046 70 IHC 19700 LB GVW TRUCK 304 CID V8 ENGINE



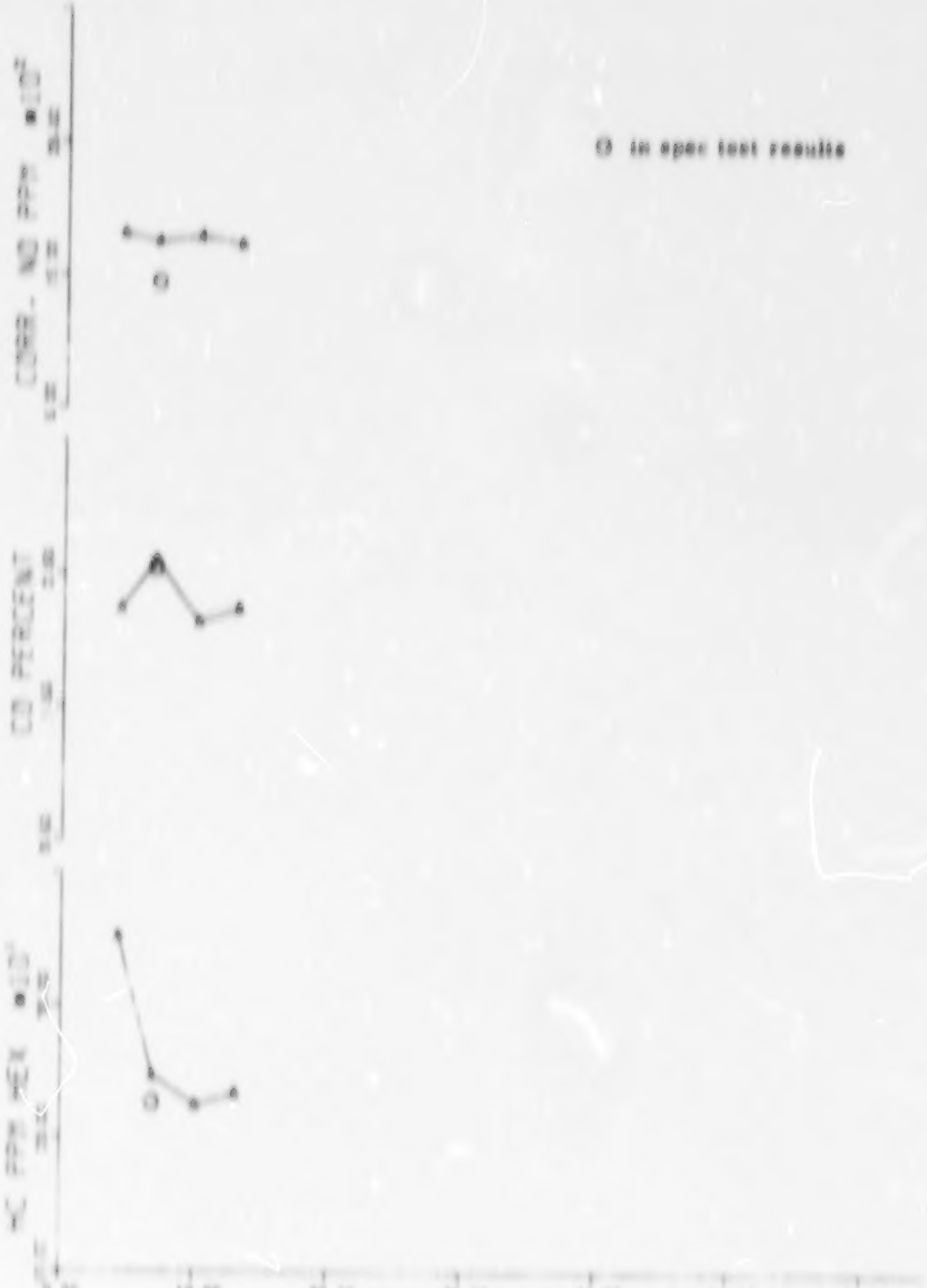
UNIT 047 IN THE 19700 LB GVW SERVICE 304 CID V8 ENGINE



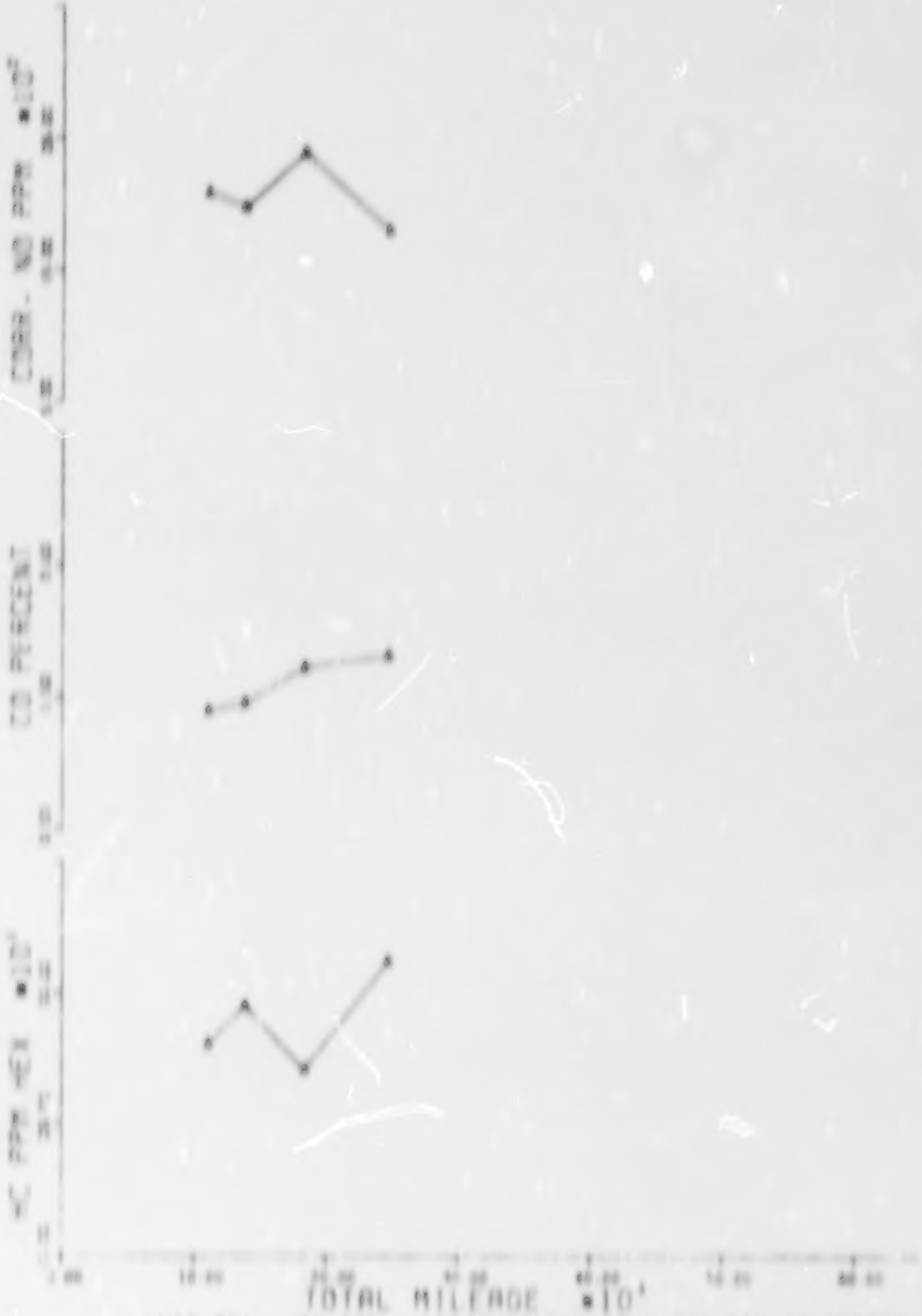
UNIT 048 TO IHC 19700 LB GVW SERVICE 304 CID V8 ENGINE



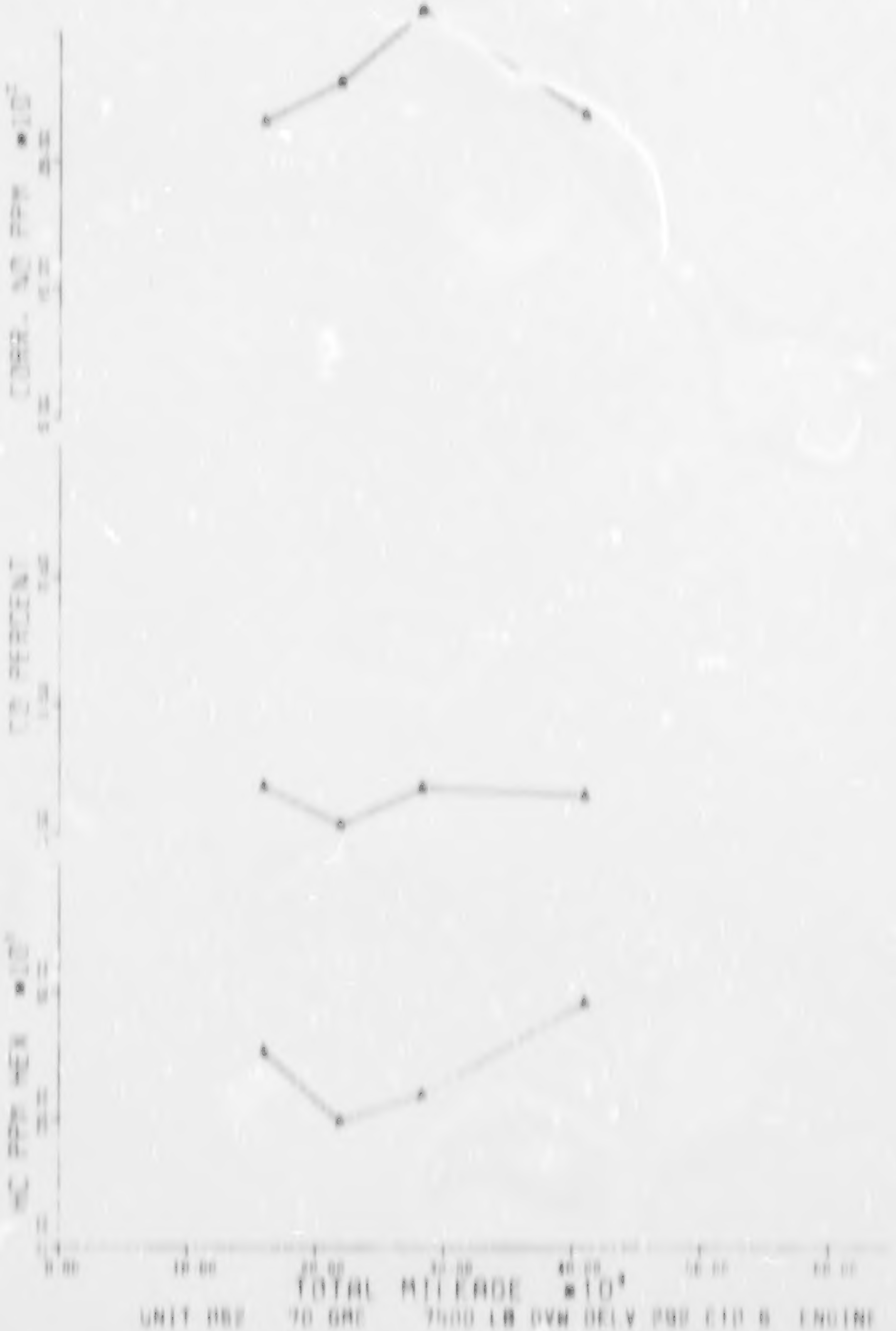
UNIT 049 TO IHC 10000 LB GVW CREW TR 304 CID V8 ENGINE



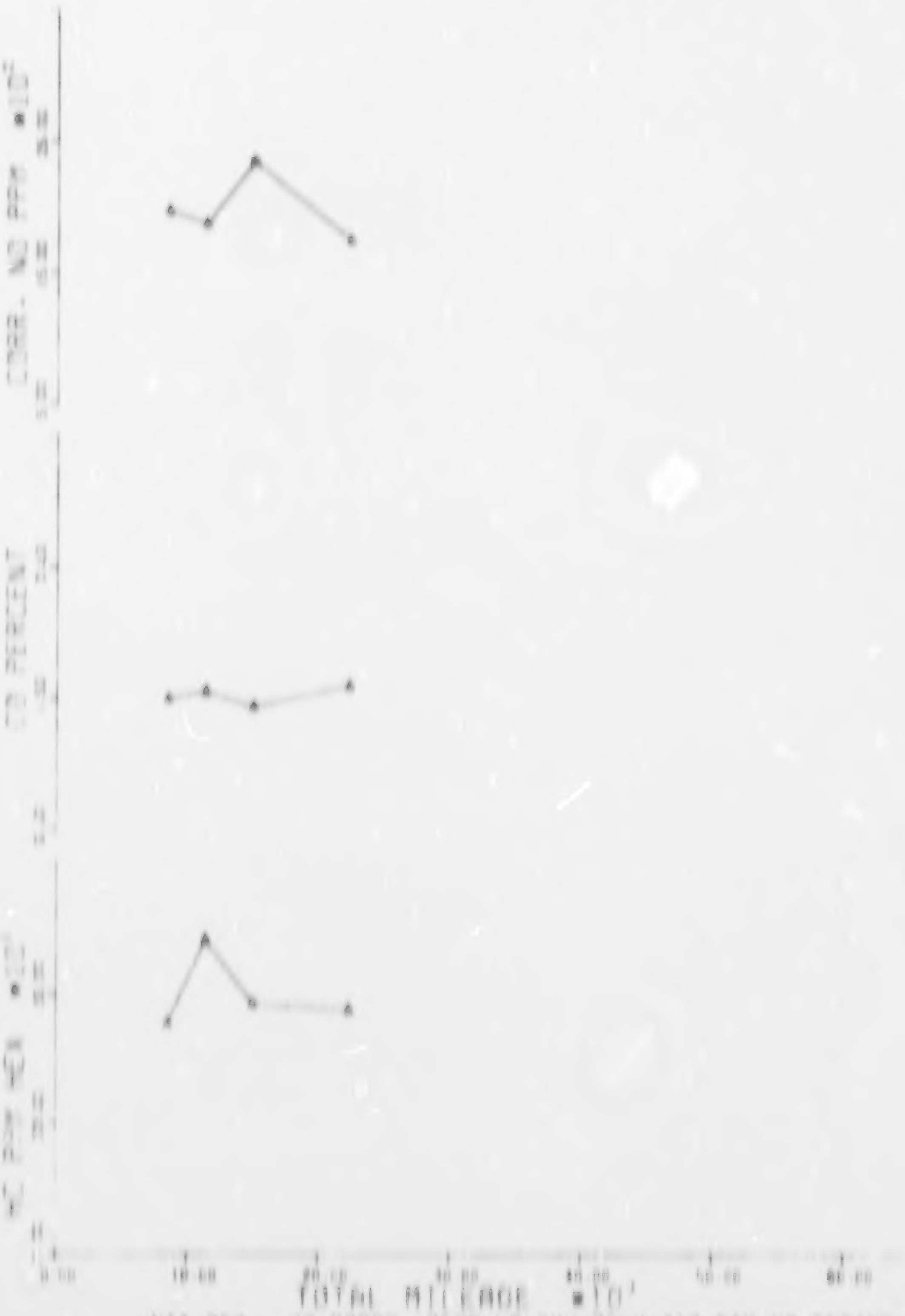
UNIT 060 TO THE 10000 LB GVW CREW TR 304 CID V8 ENGINE



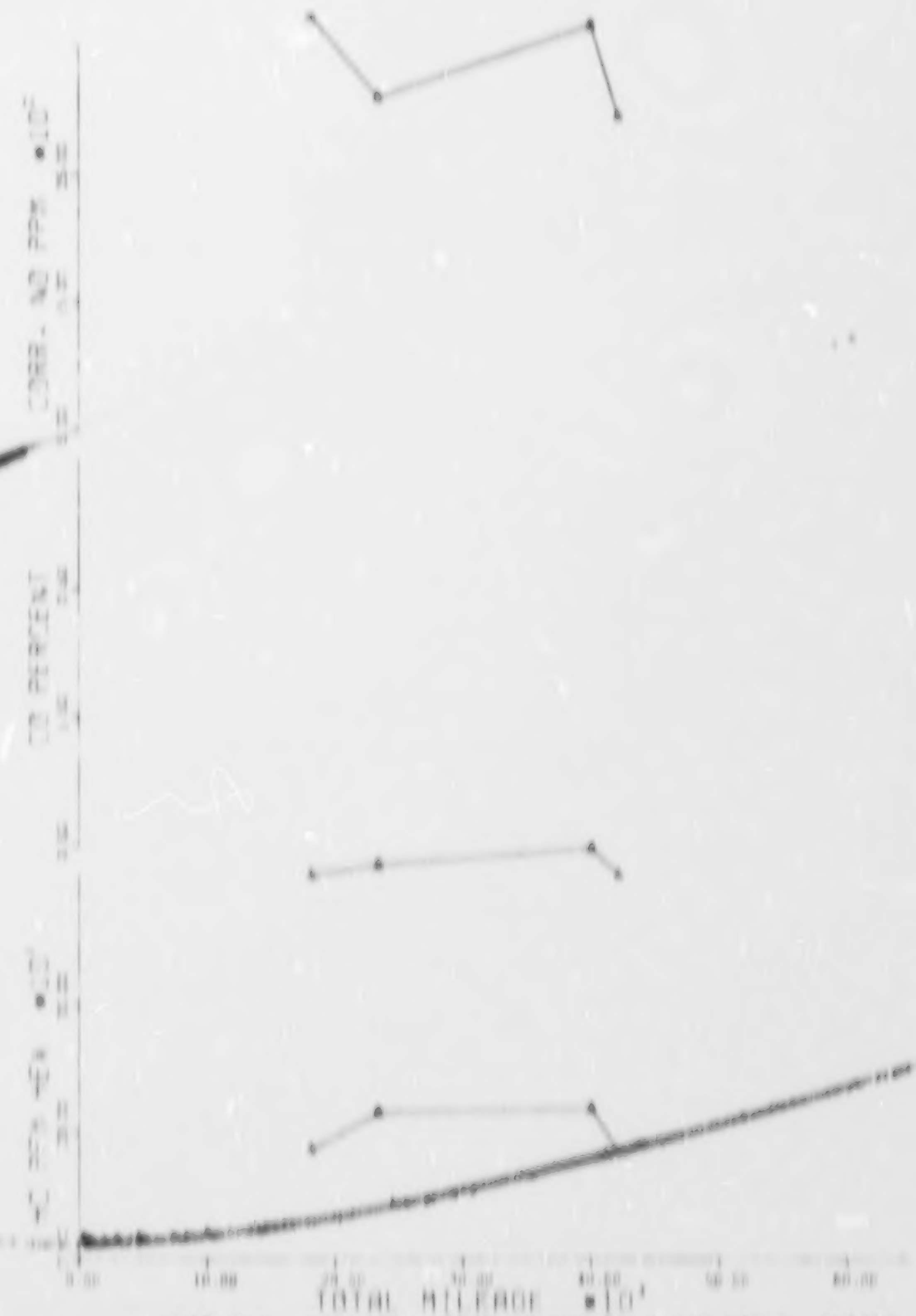
UNIT 081 73 IHC 7500 LB GVW DEL. 304 CID V8 ENGINE



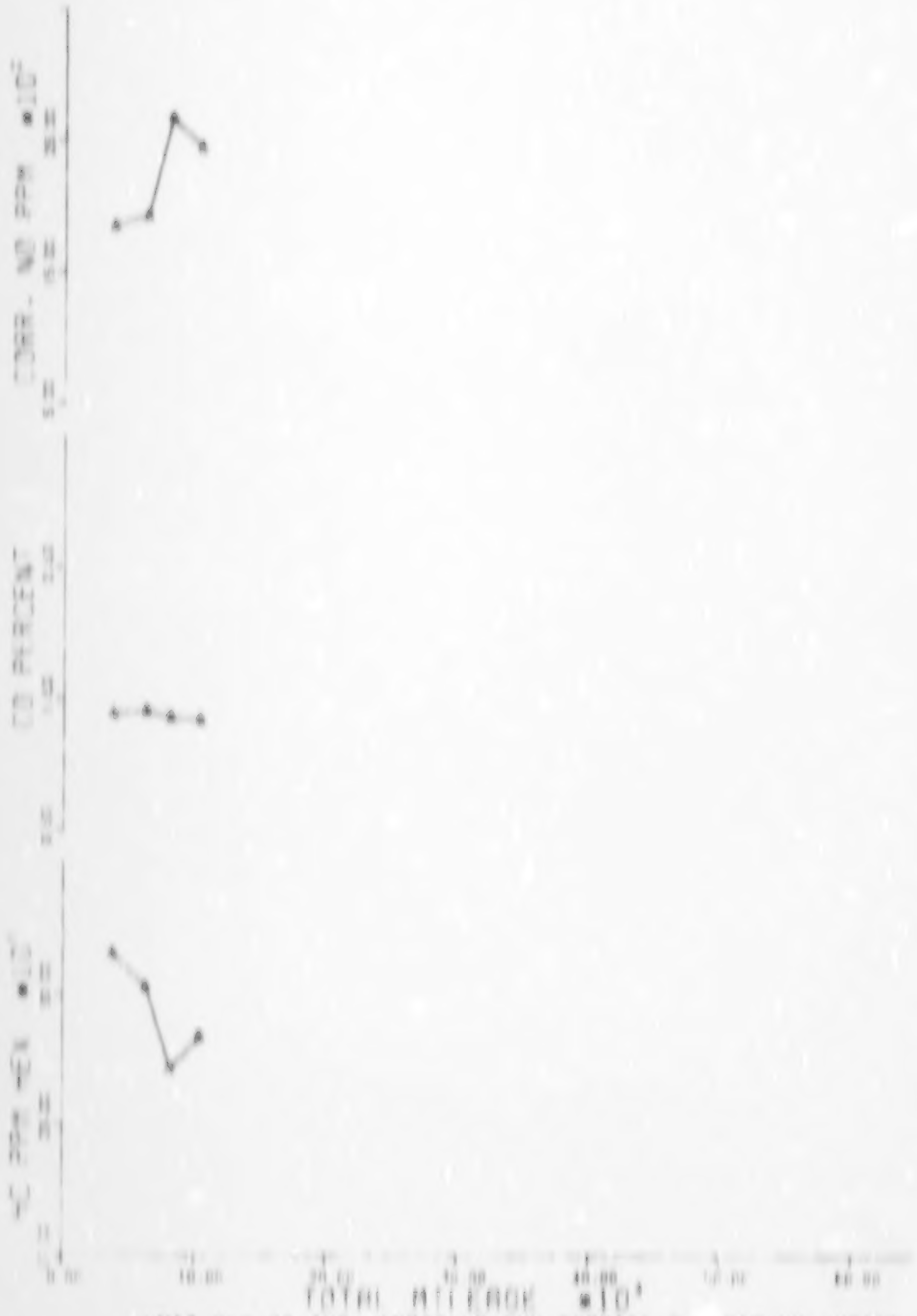
UNIT 082 70 GMC 7500 LB GVW DELV 292 CID 6 ENGINE



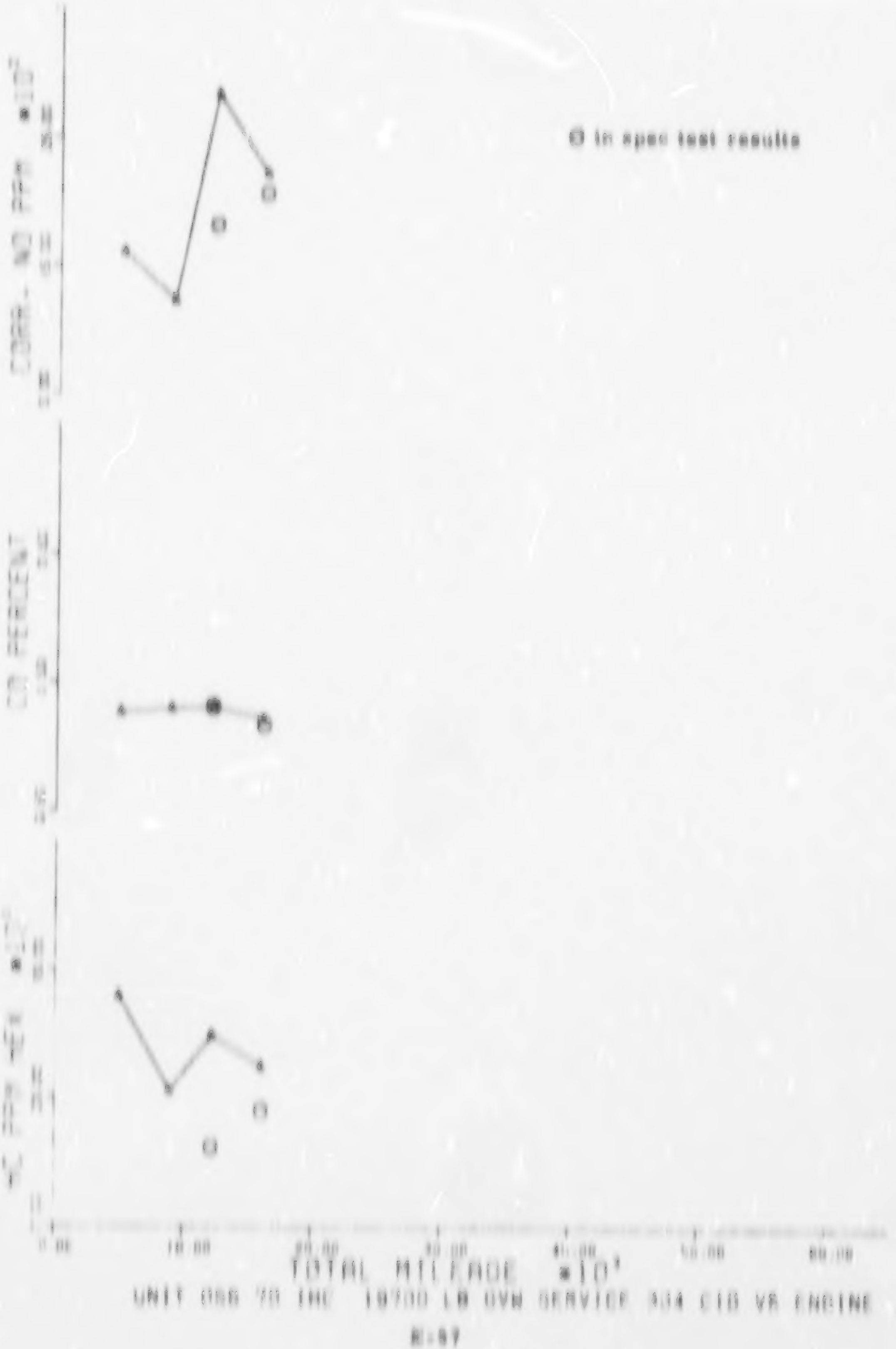
UNIT 053 73 DODGE 7500 LB GVW DELV 318 CID V8 ENGINE



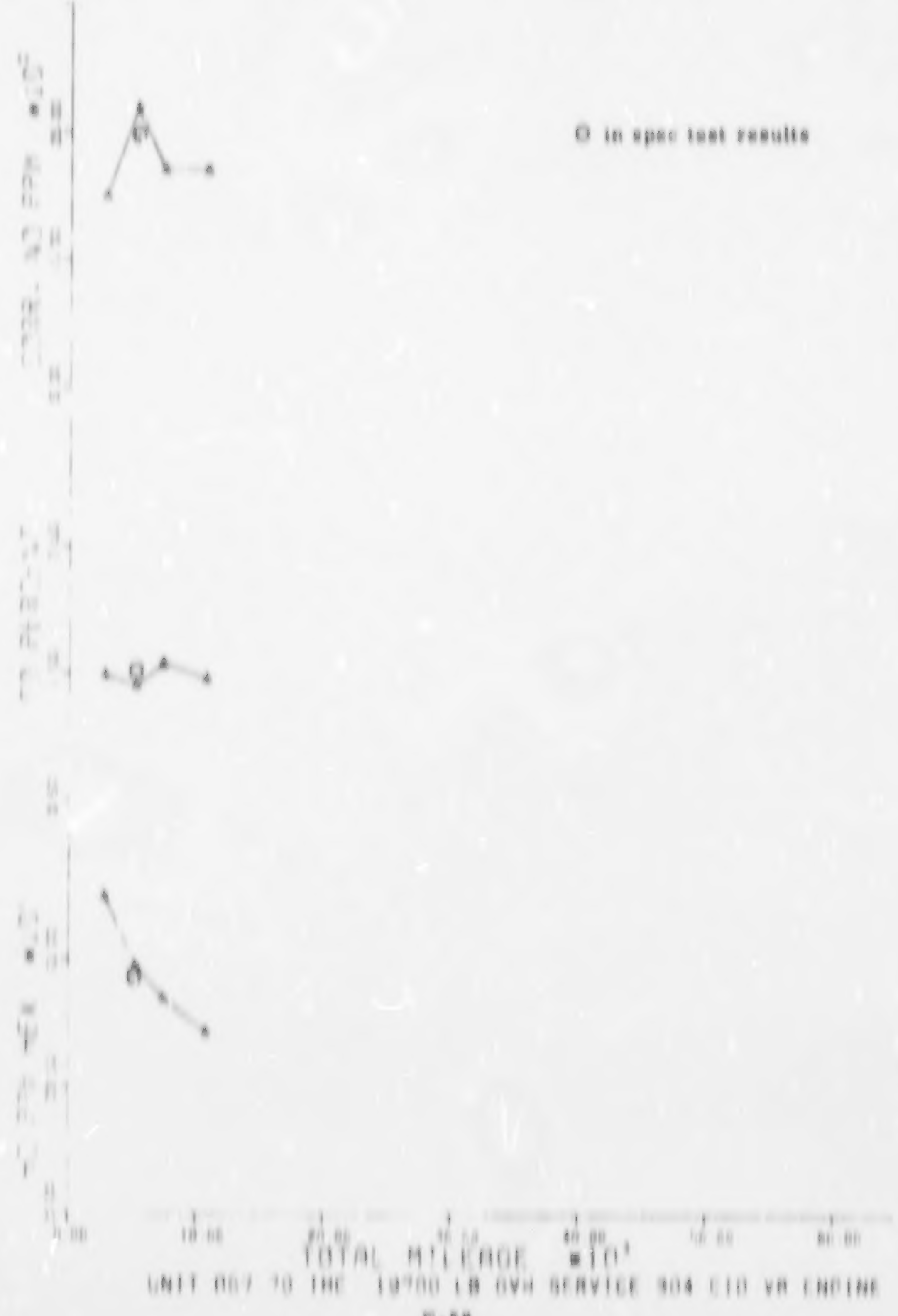
UNIT 064   75 FORD   7500 LB GVW DELV 300 CID 6 ENGINE



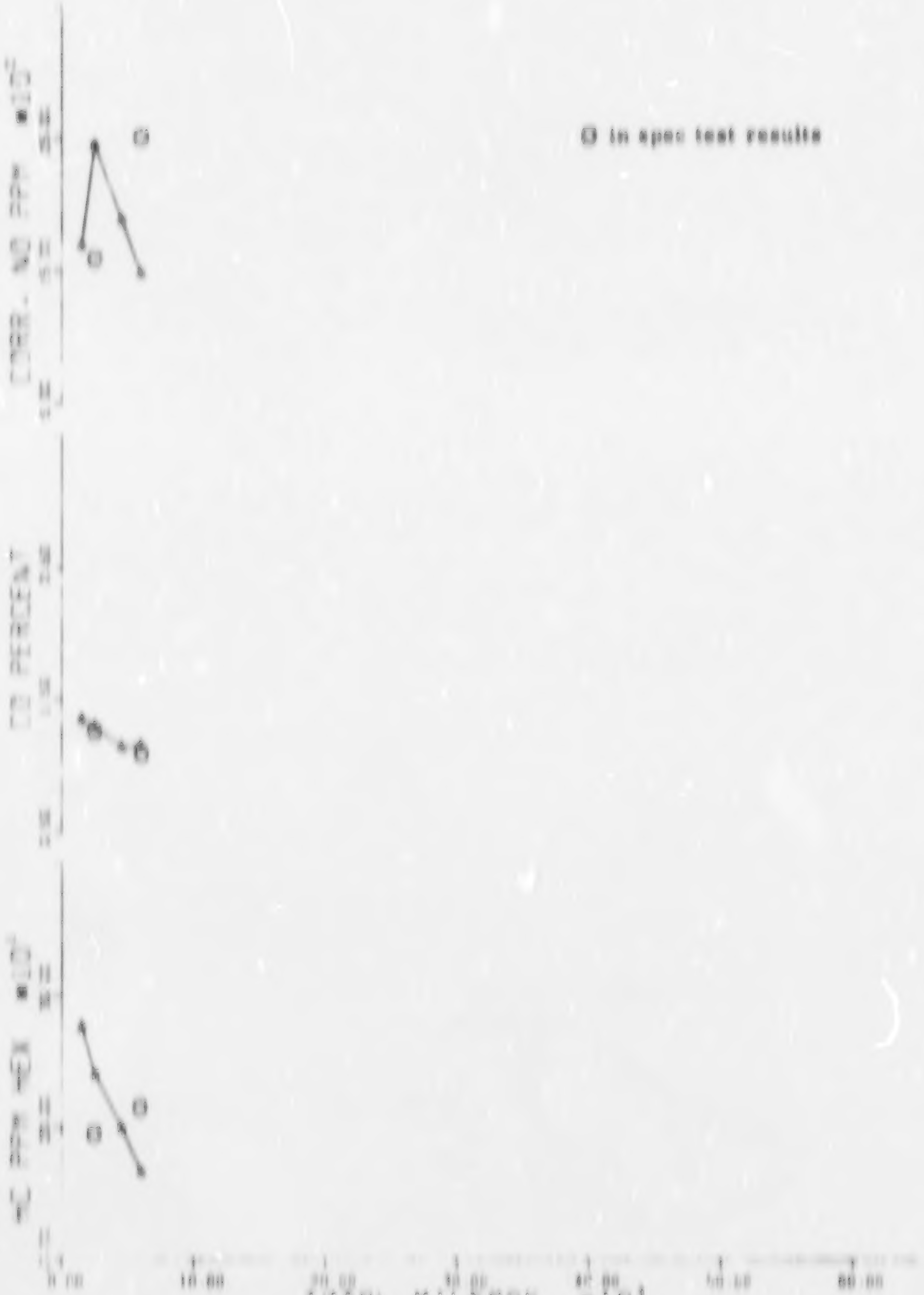
UNIT 008 70 IHC 19700 LB GVW SERVICE 345 CID V8 ENGINE



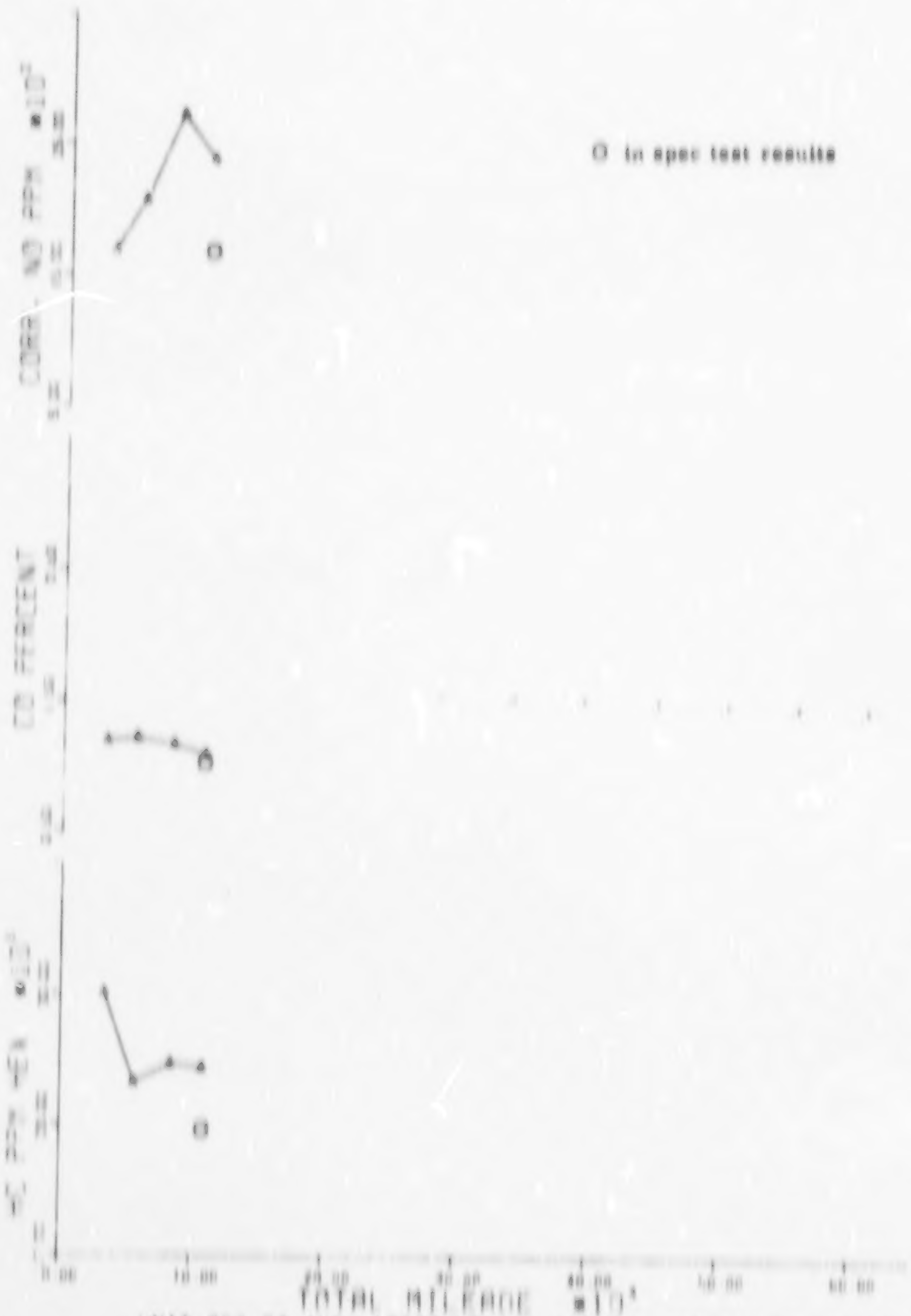
UNIT 056 70 IHC 18700 LB GVW SERVICE 304 CID V8 ENGINE



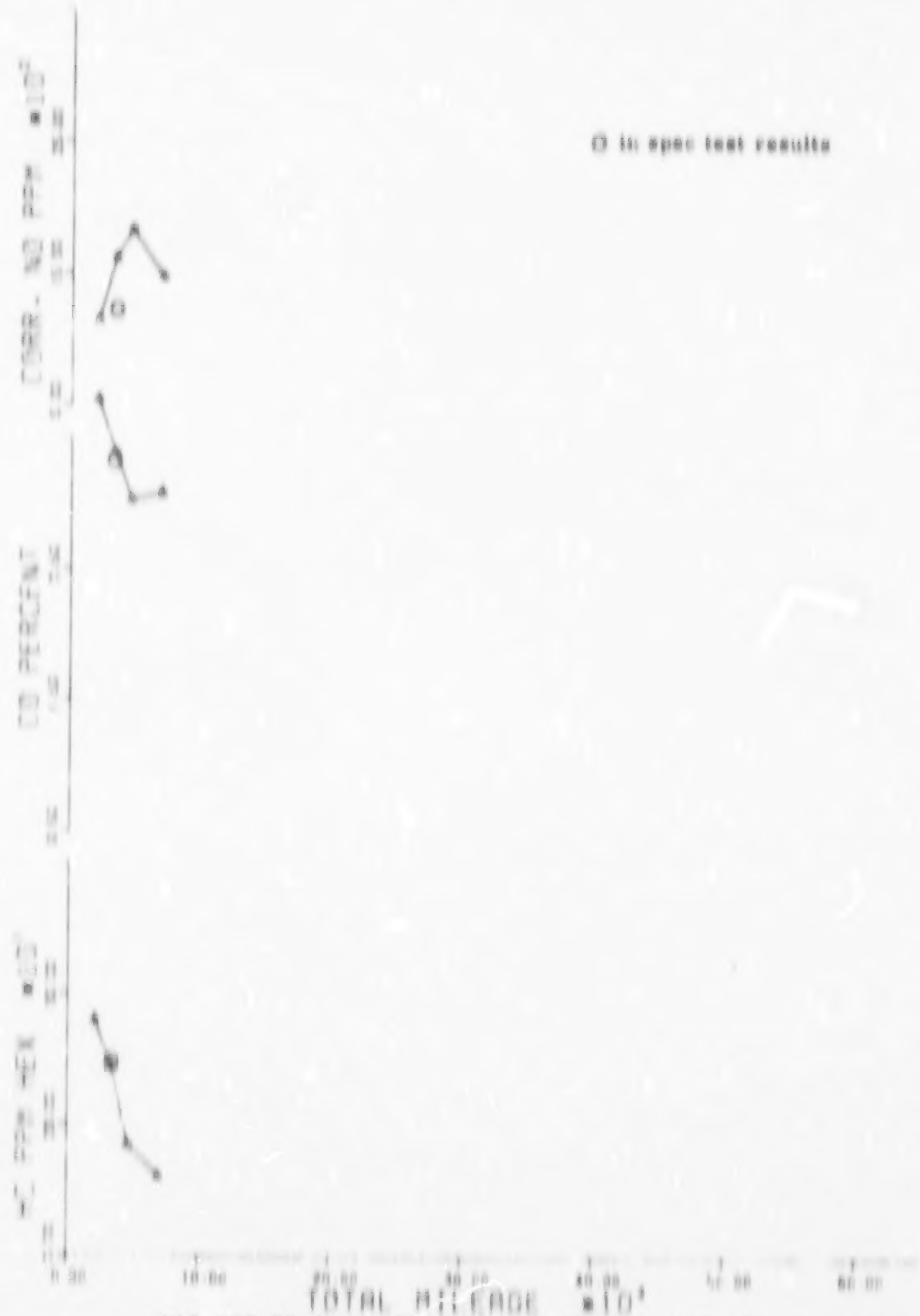
UNIT 067 TO THE 19700 LB GVW SERVICE 304 CID V8 ENGINE



UNIT OUR TO THE 19700 LB GVW SERVICE 304 CID V8 ENGINE

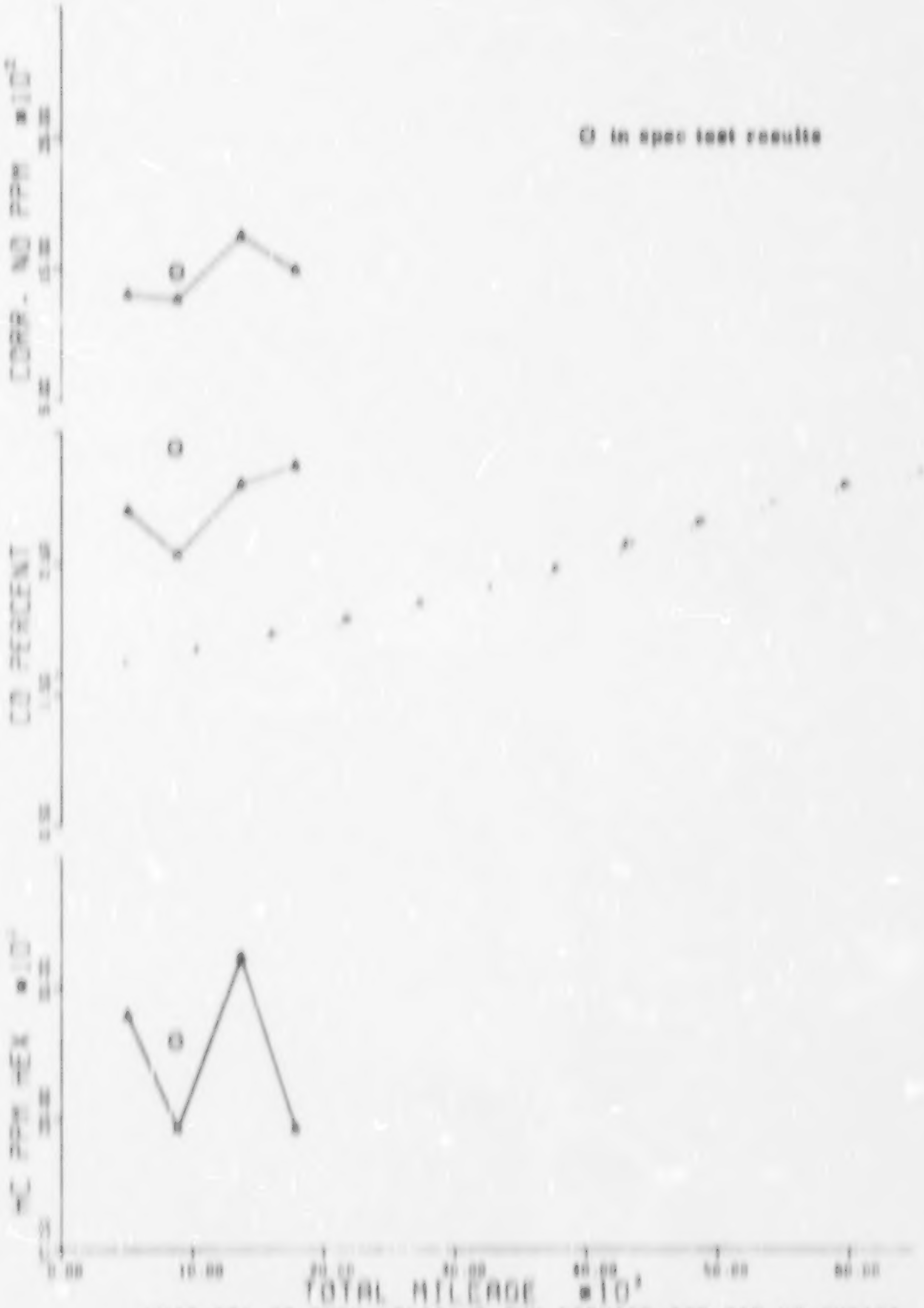


UNIT 059 TO THE 19700 LB GVW SERVICE 304 CID V8 ENGINE

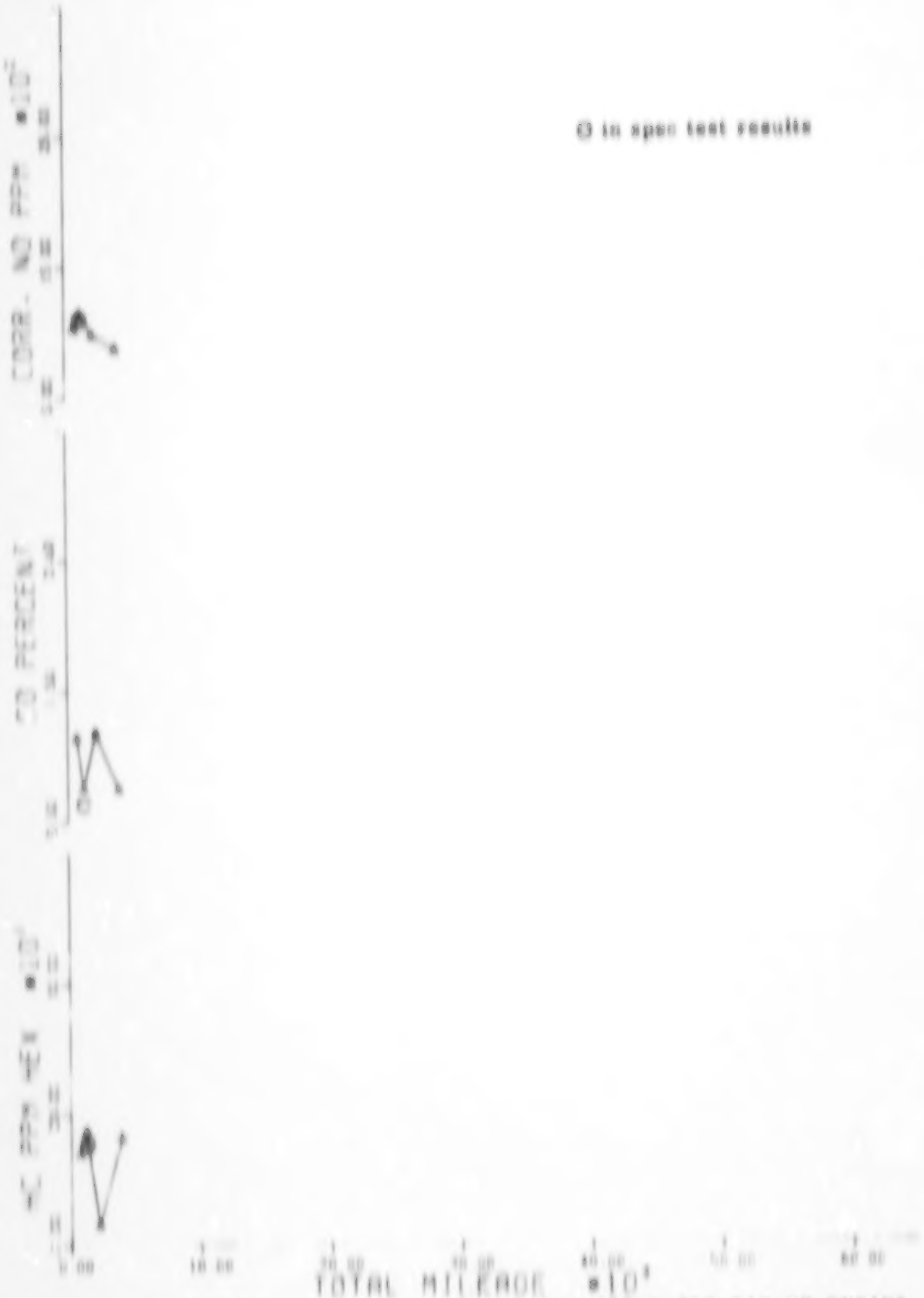


TOTAL MILEAGE *10³

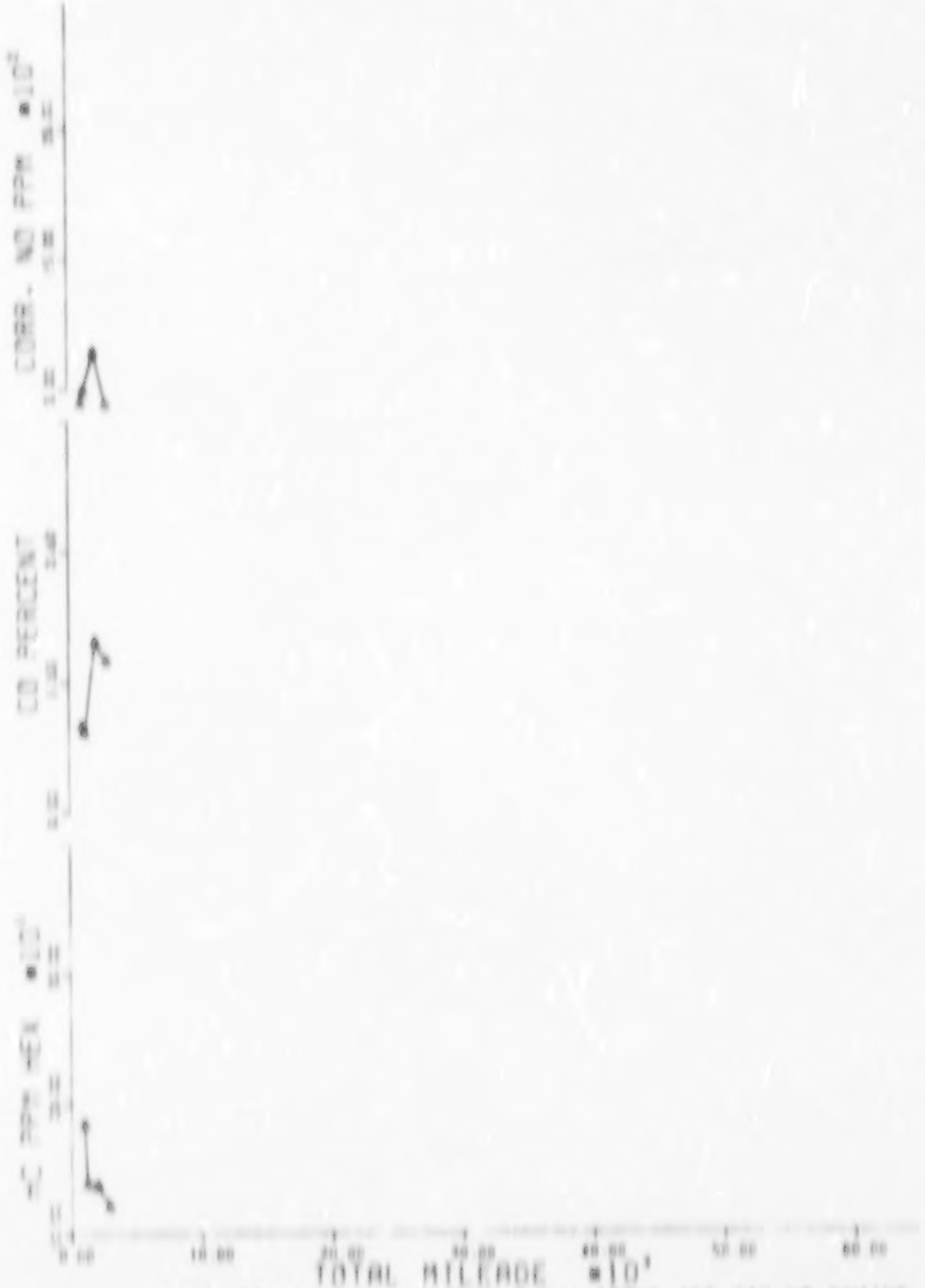
UNIT 080 73 CHEV 7500 LB GVW SERVICE 307 CID V8 ENGINE



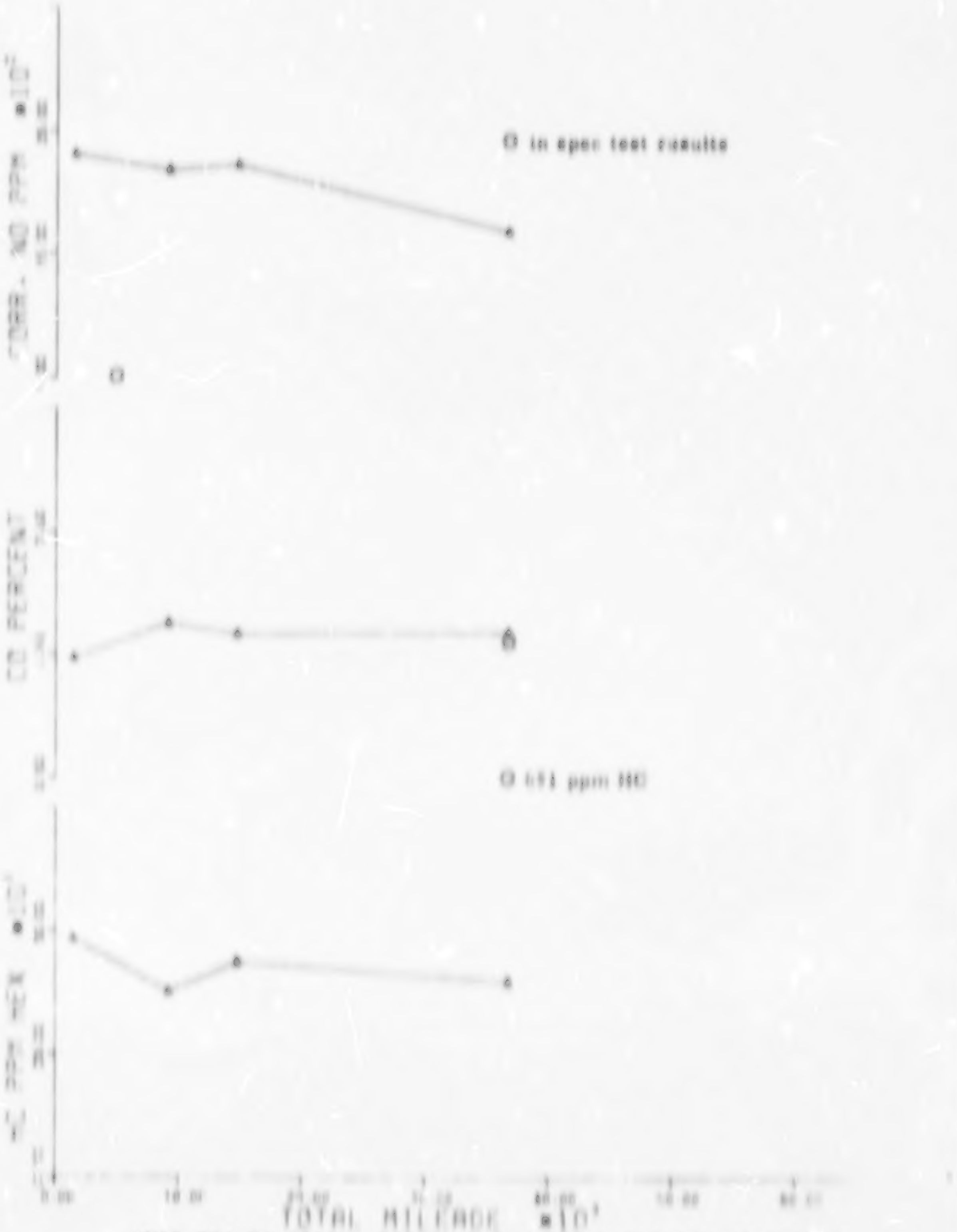
UNIT 081 70 CHEV 7500 LB GVW SERVICE 307 CID V8 ENGINE



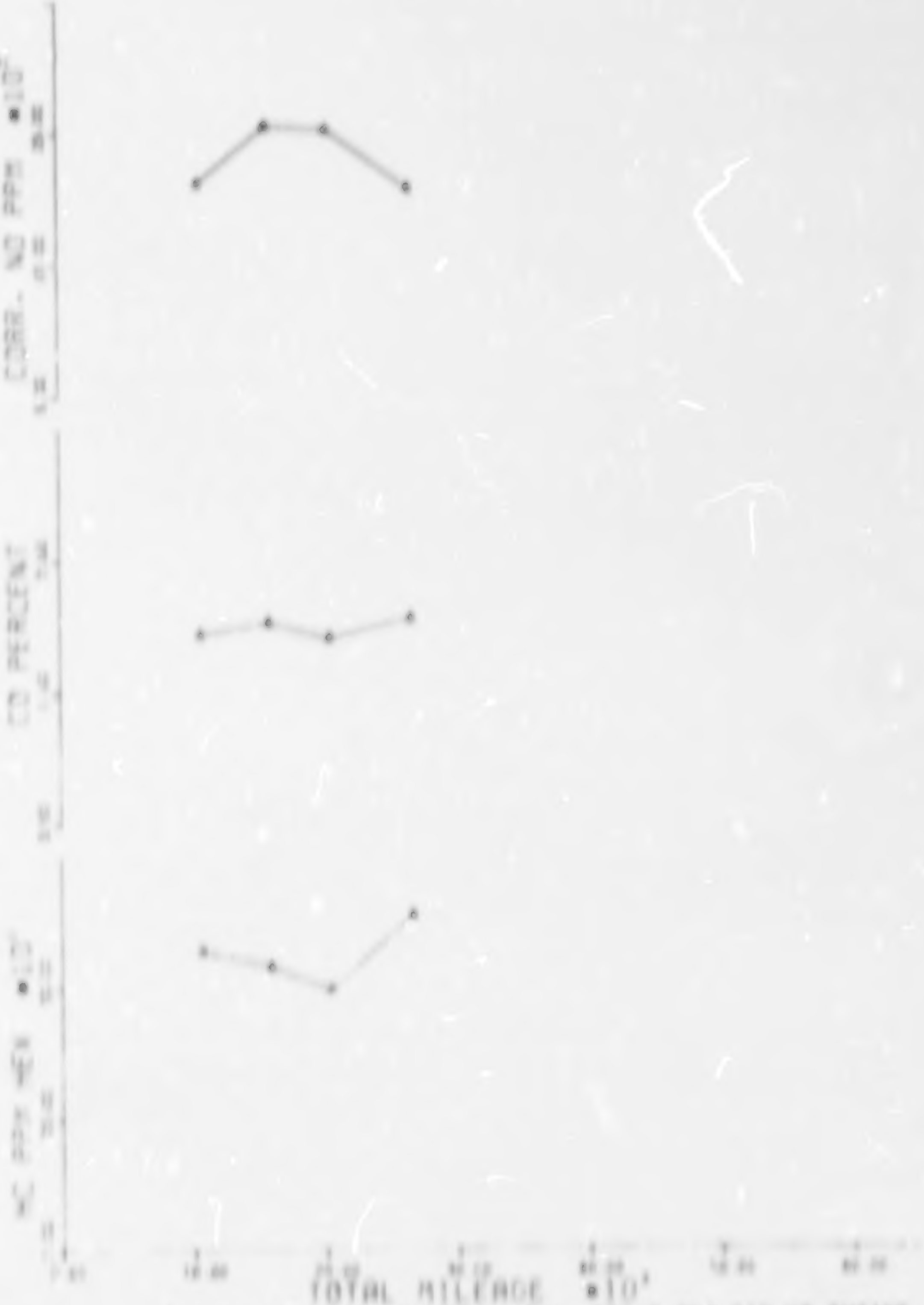
UNIT 062 70 CHEV 32000 LB GVW CRANE 366 CID V8 ENGINE



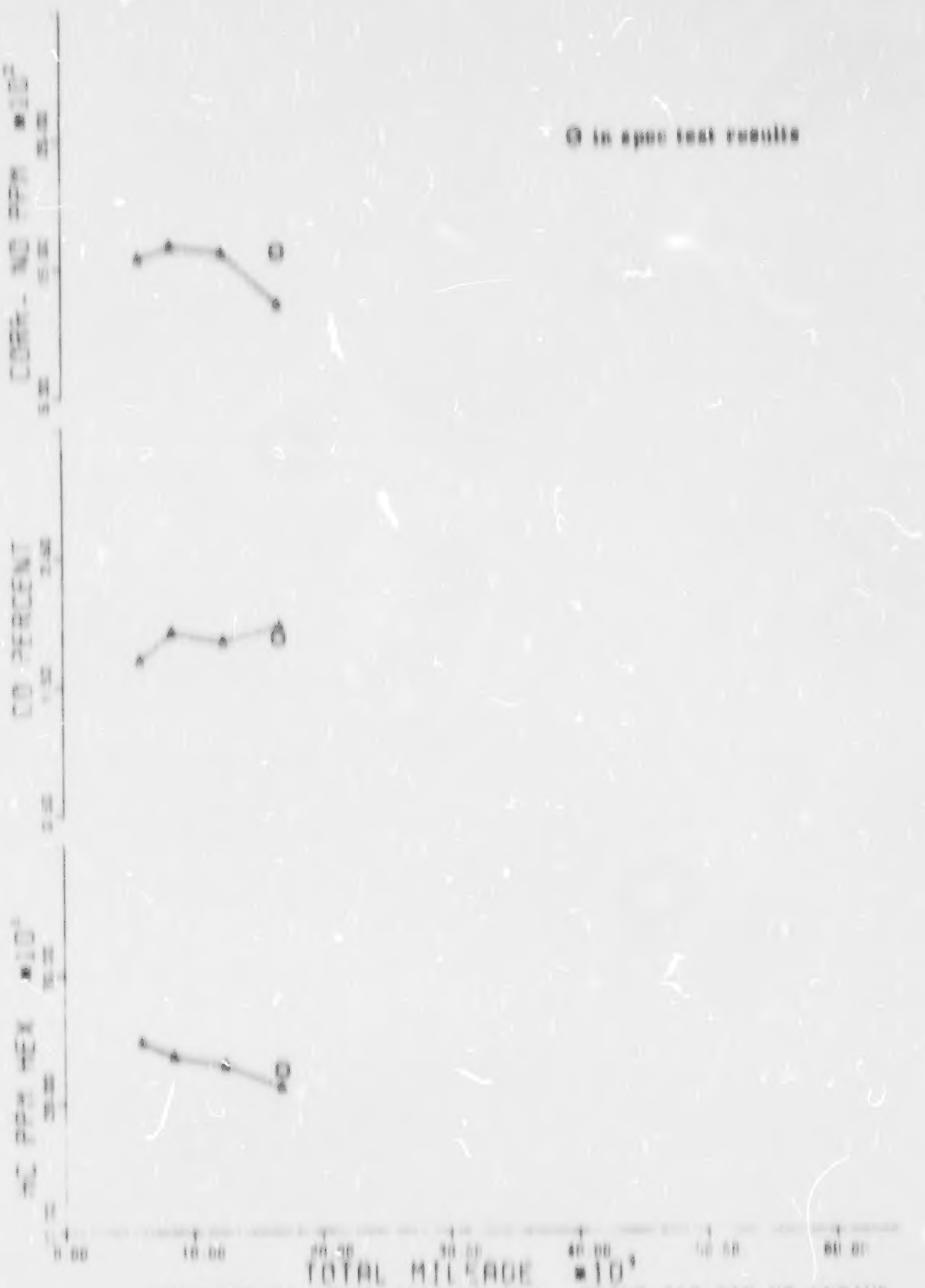
UNIT 083 70 CHEV 32000 LB GVW CRANE 366 CID V8 ENGINE



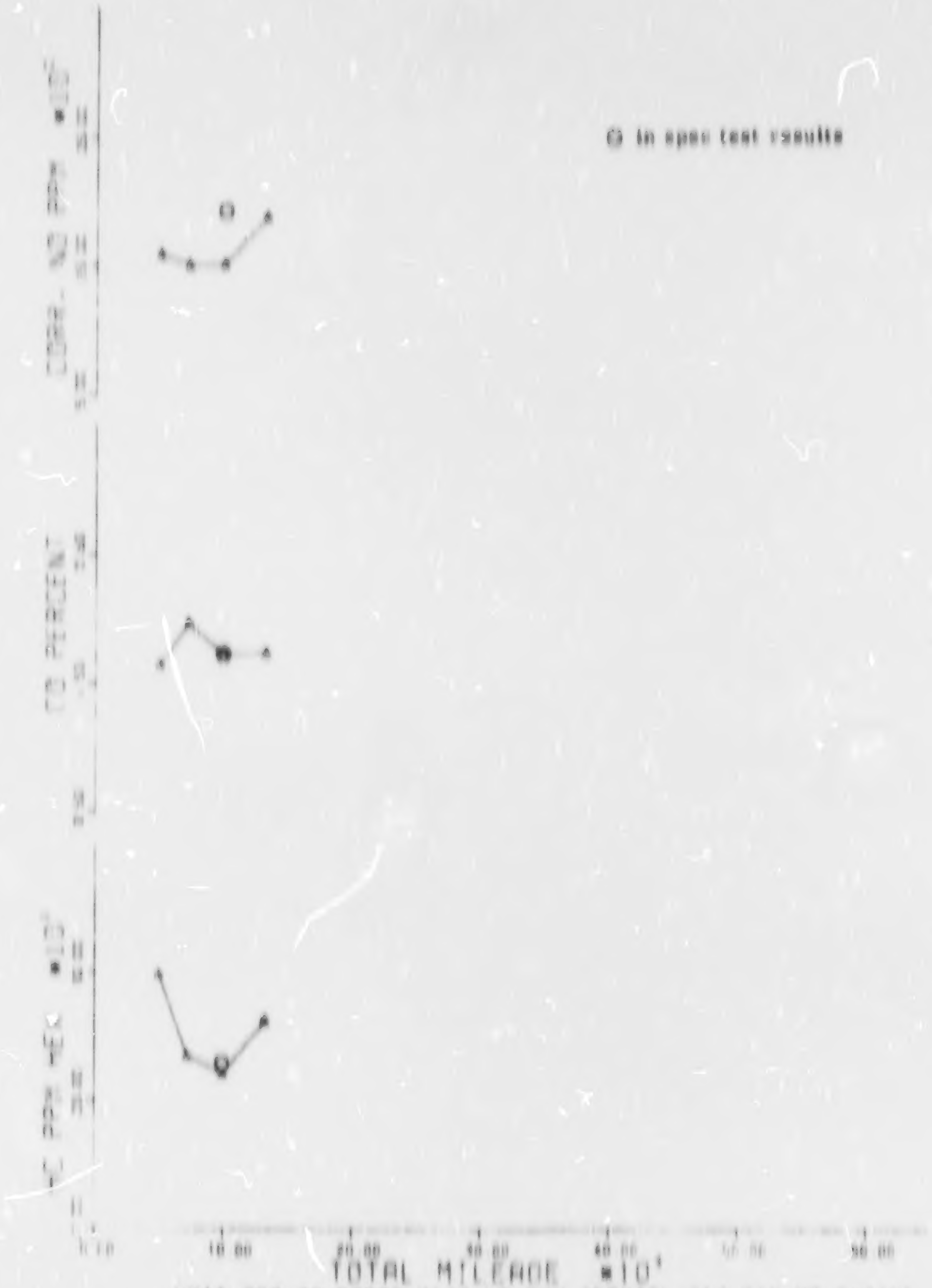
UNIT 064 TO DODGE 24000 LB GVW FRONT 318 CID V8 ENGINE



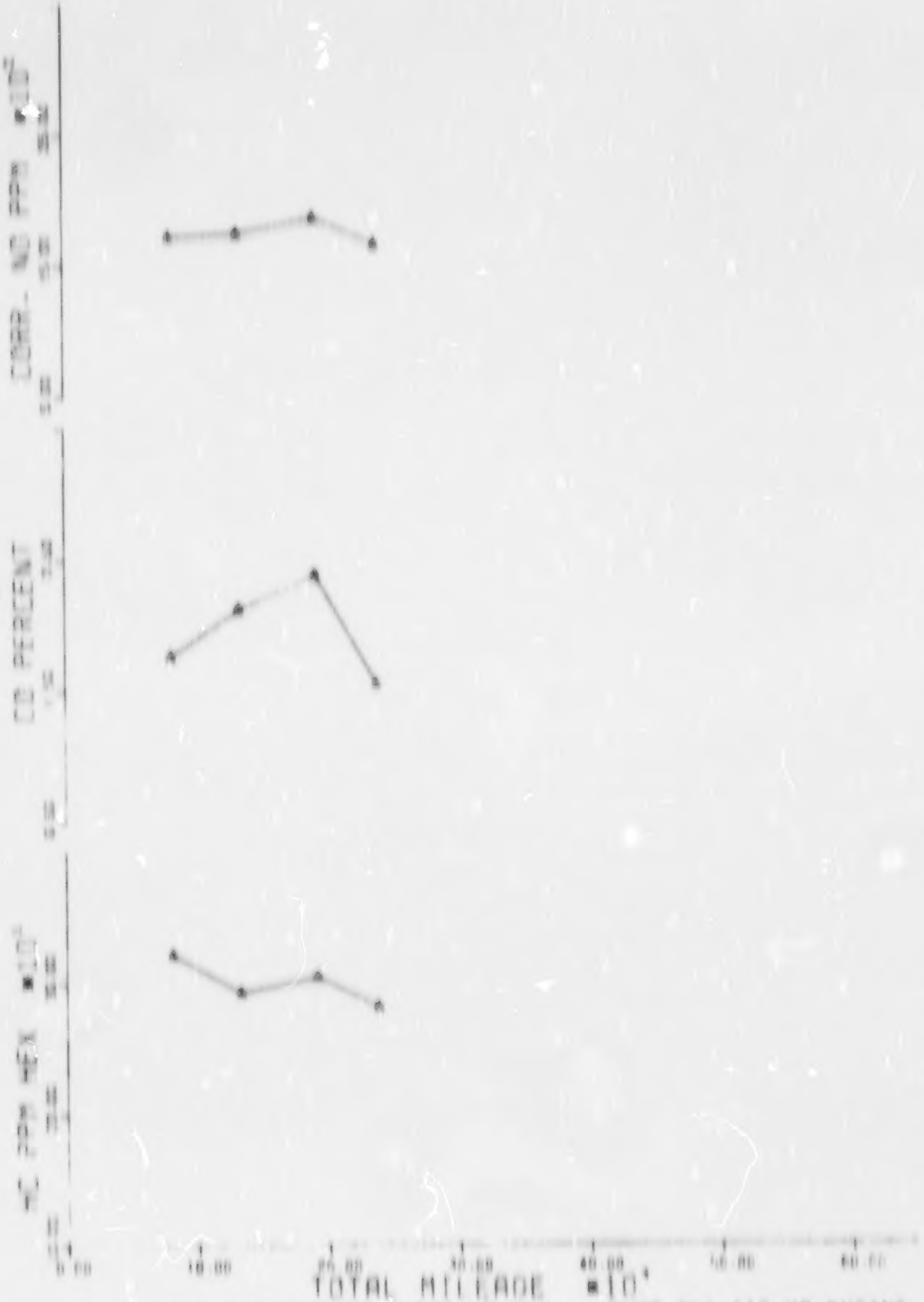
UNIT 055 TO DODGE 7400 LB GVW FRONT 318 CID V8 ENGINE



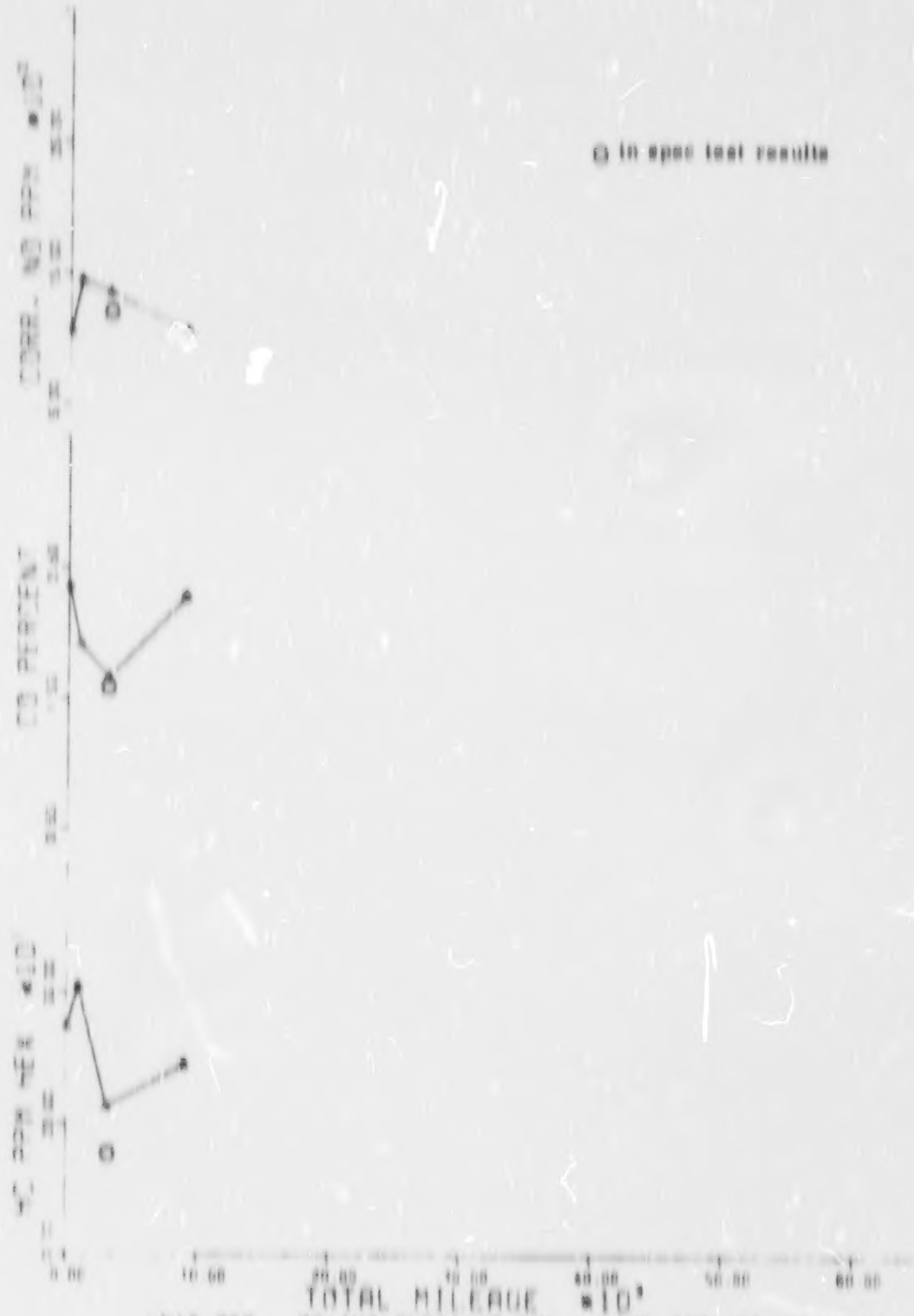
UNIT 086 70 DODGE 7500 LB GVW METER 318 CID V8 ENGINE



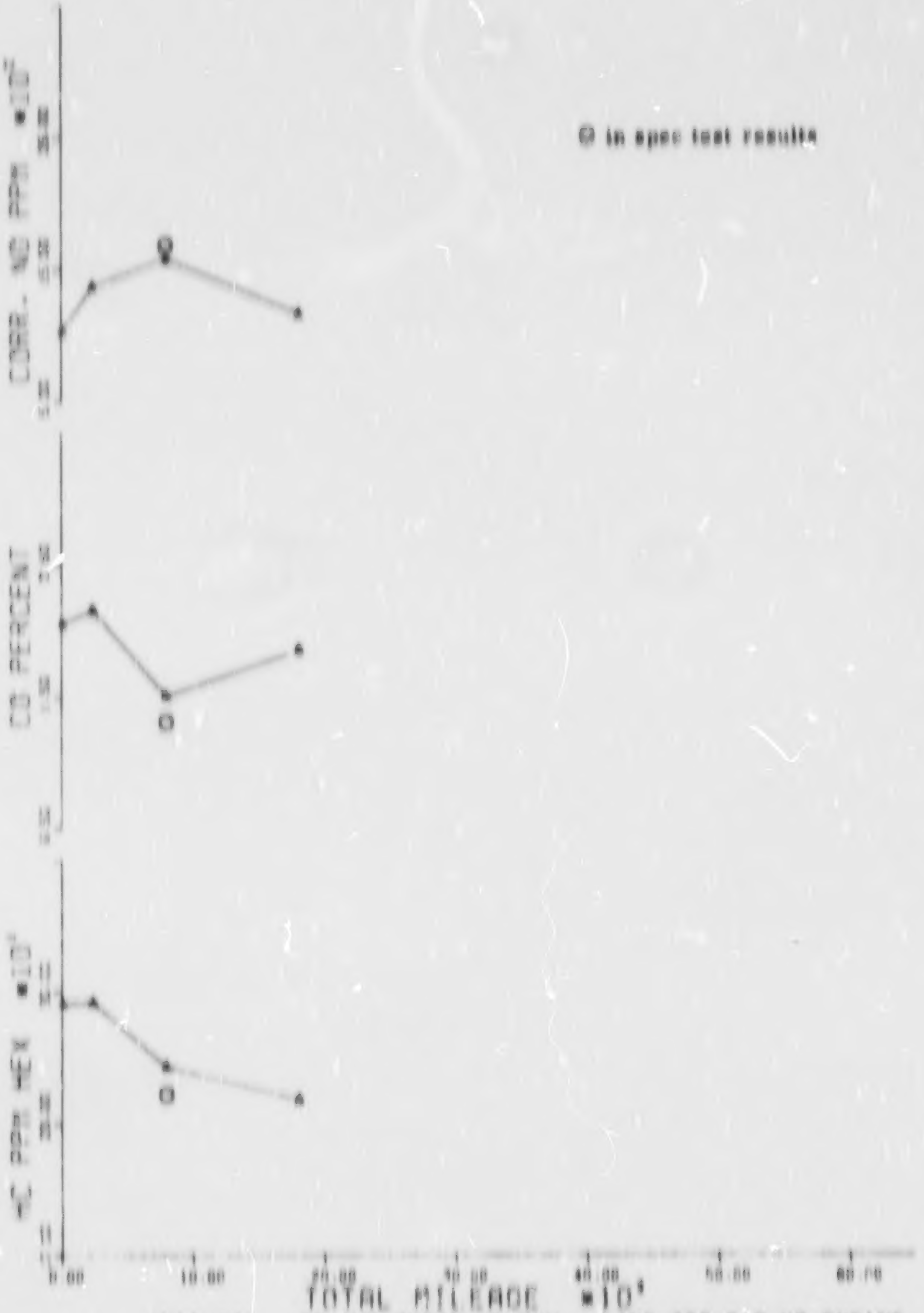
UNIT 087 70 DODGE 7500 LB GVW SERVICE 318 CID V8 ENGINE



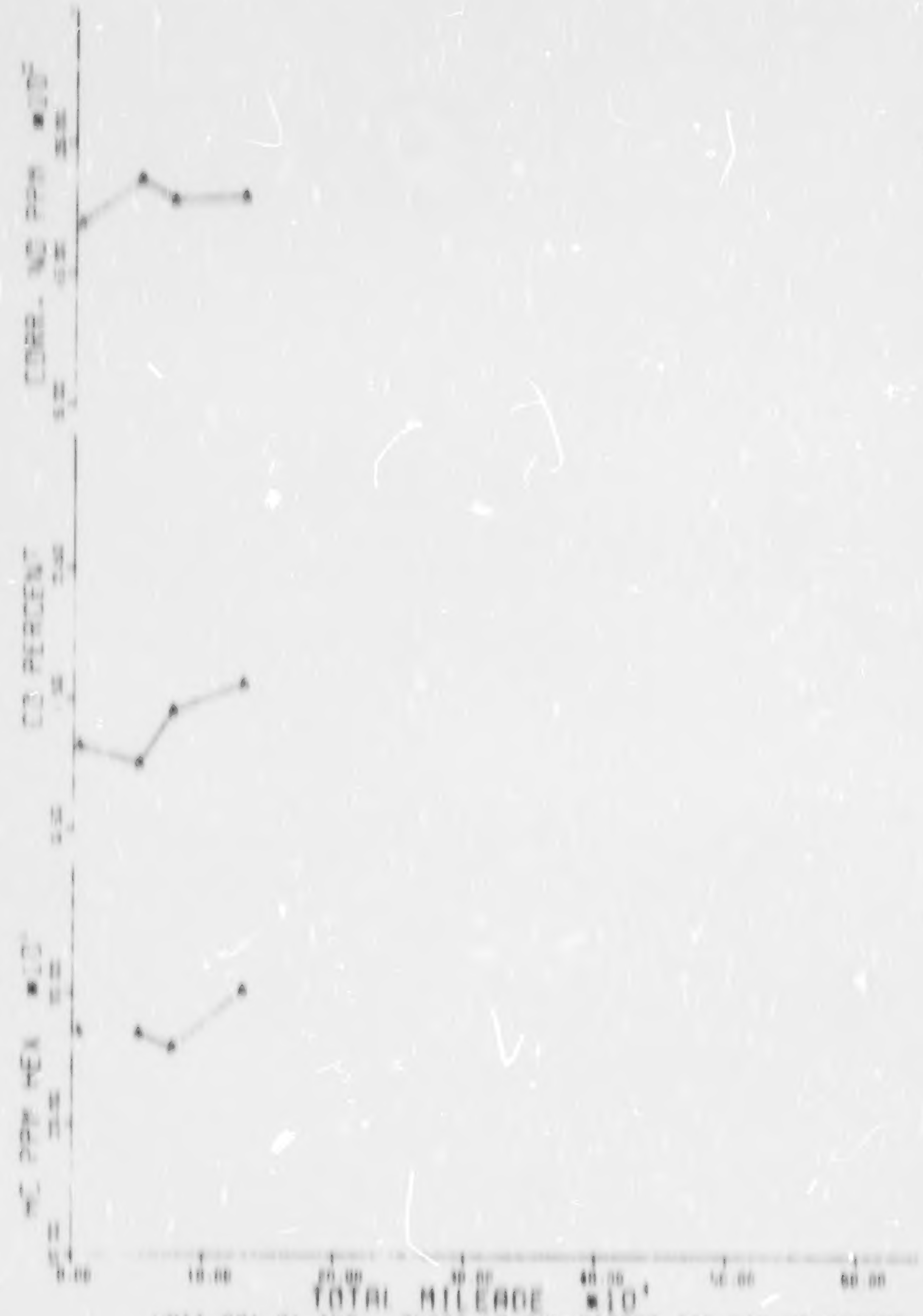
UNIT 088 70 FORD 26500 LB GVW SUMP 361 CID V8 ENGINE



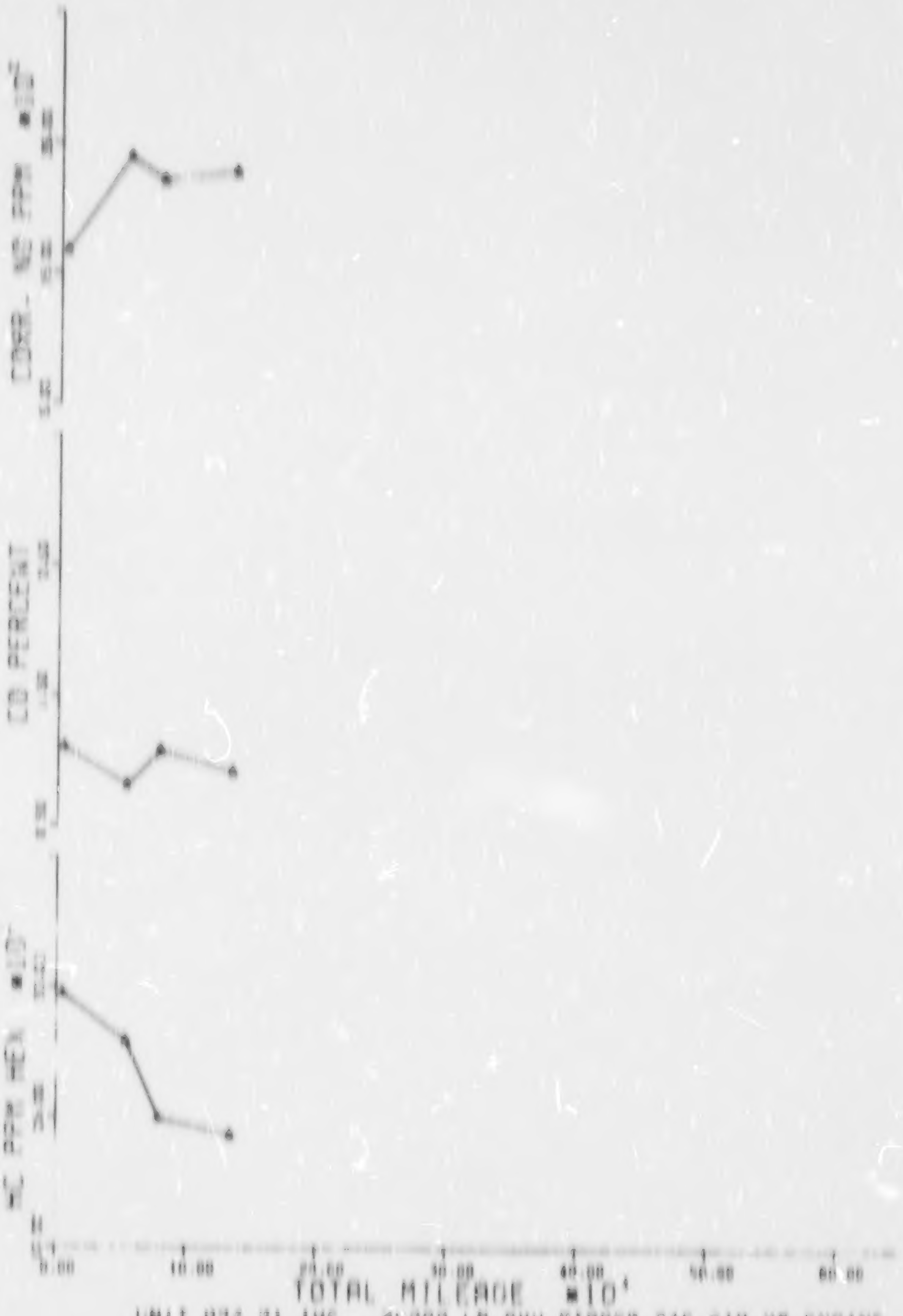
UNIT 089   70 IHC 25500 LB GVW   LINE 392 CID V8 ENGINE



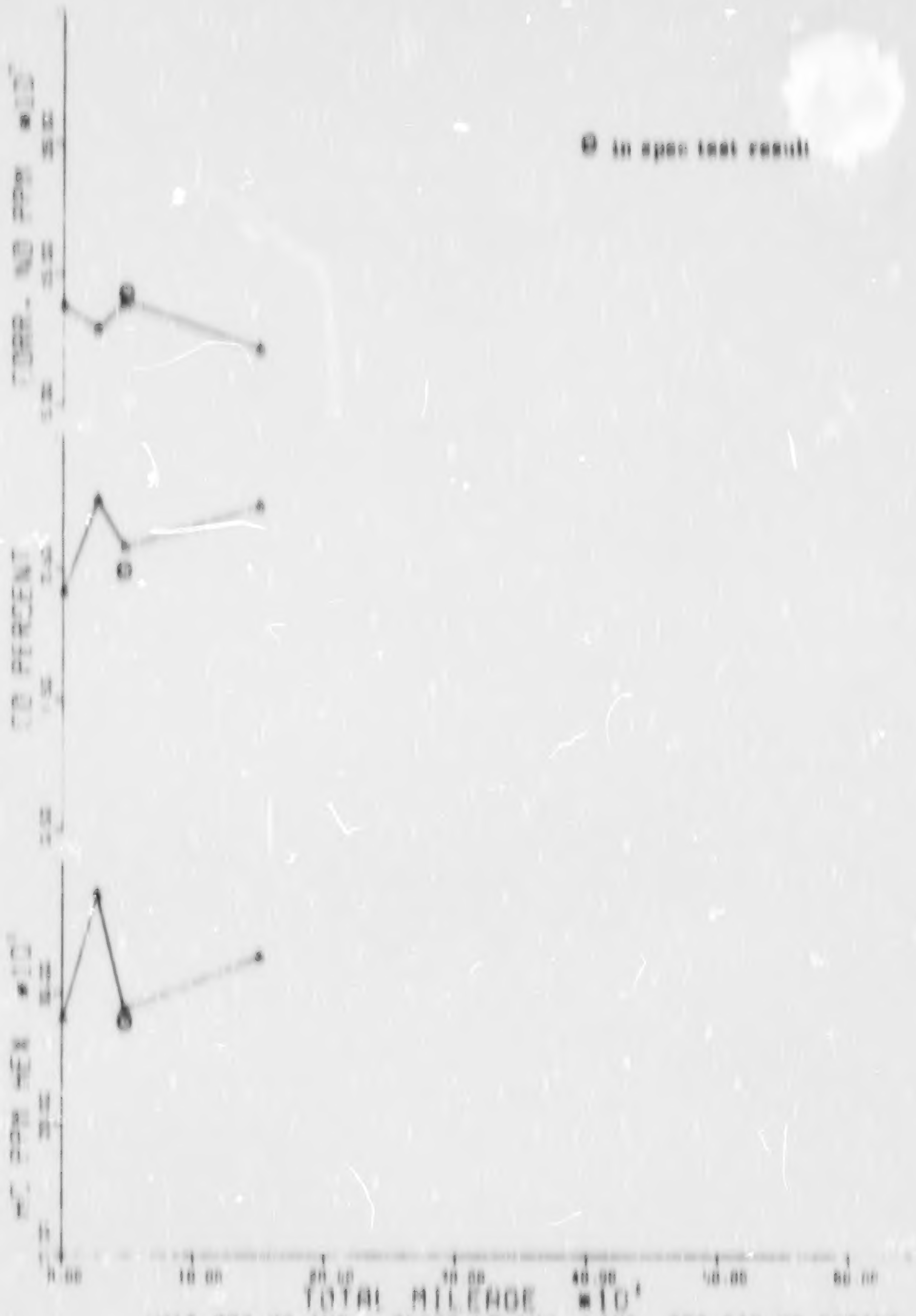
UNIT 070 70 INC 25500 LB GVW LINE 392 CID V8 ENGINE



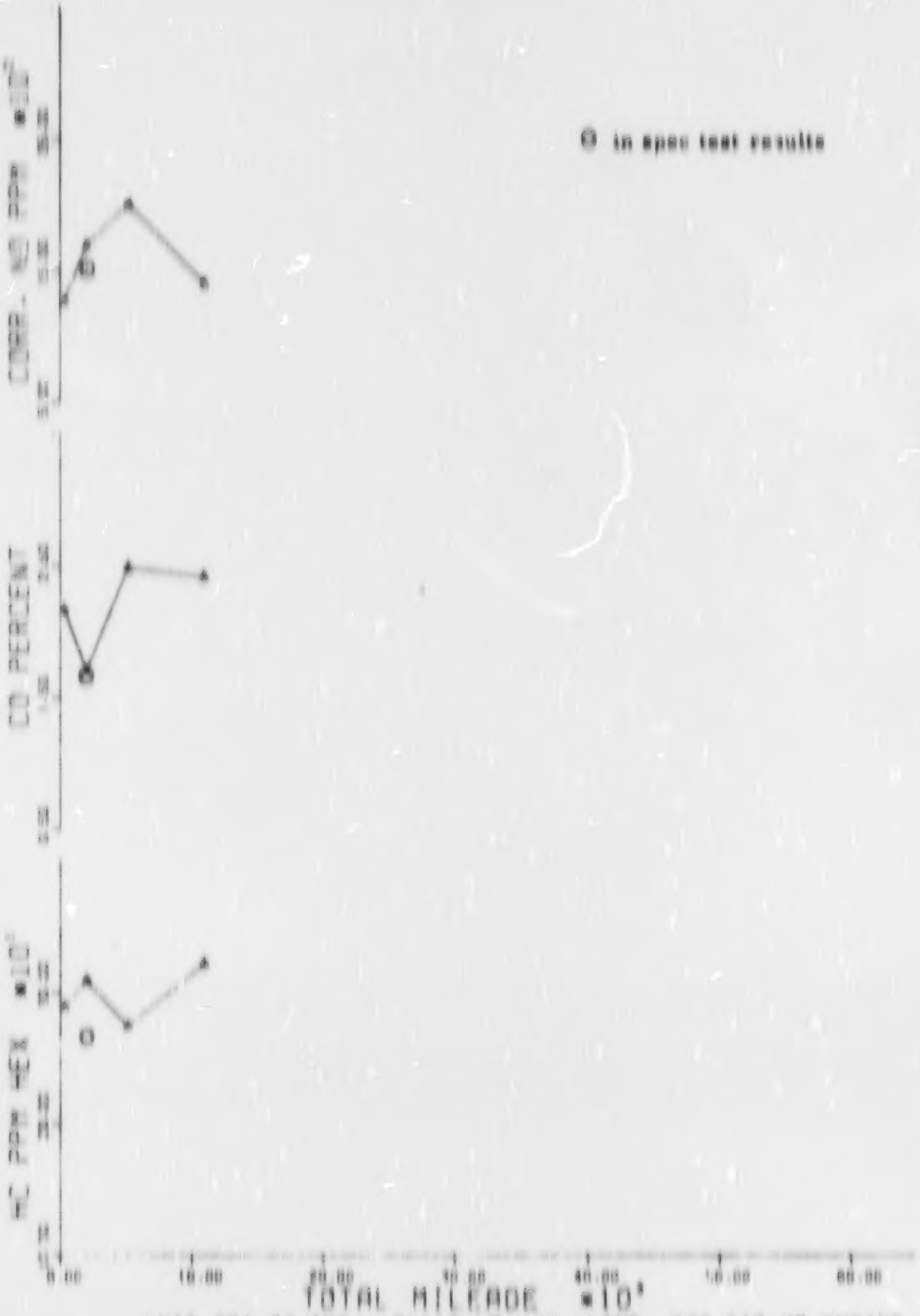
UNIT 071 71 IHC 25000 LB GVW DIGGER 345 CID V8 ENGINE



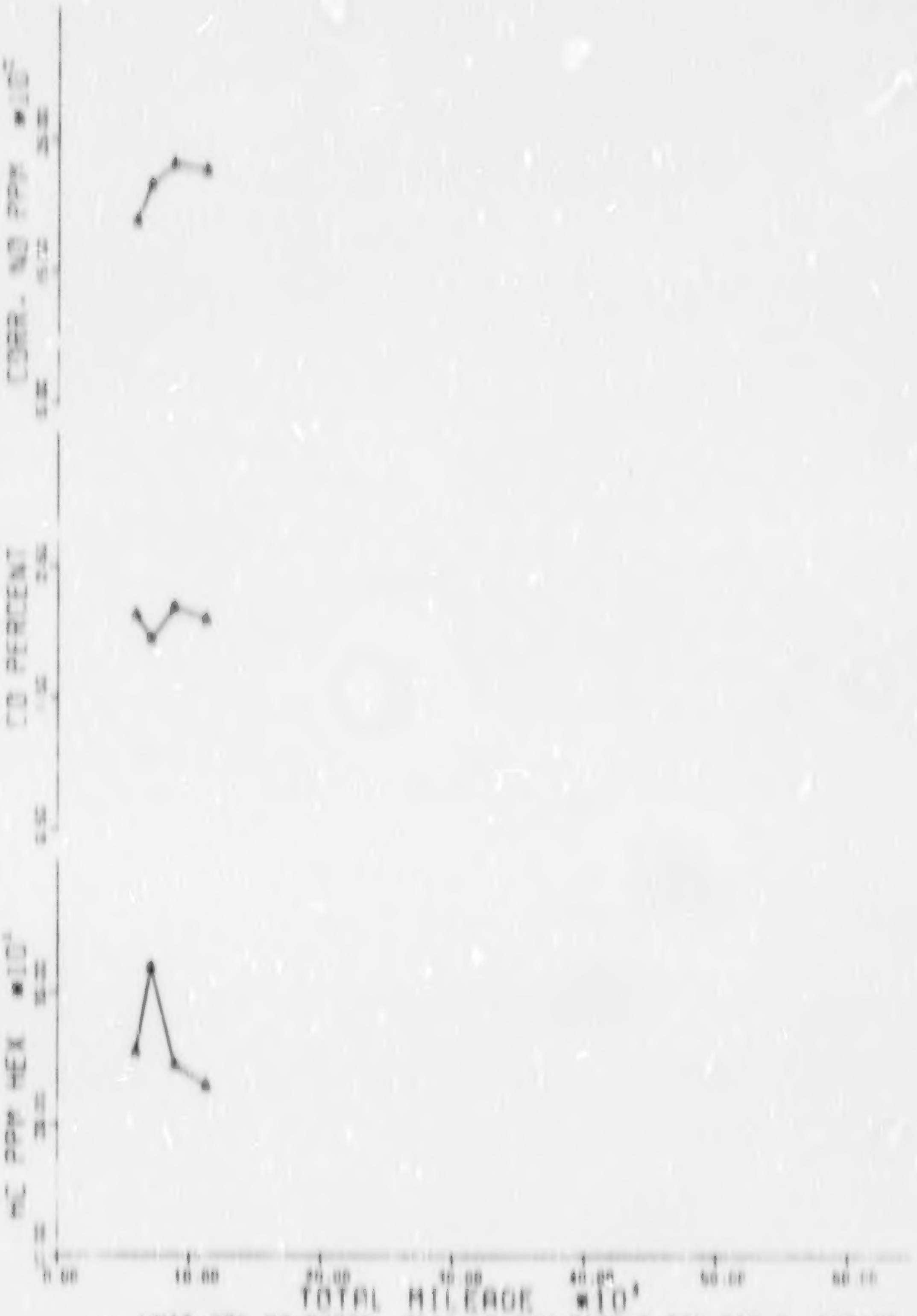
UNIT 072 71 IHC 21,000 LB GVW DIGGER 345 CID V8 ENGINE



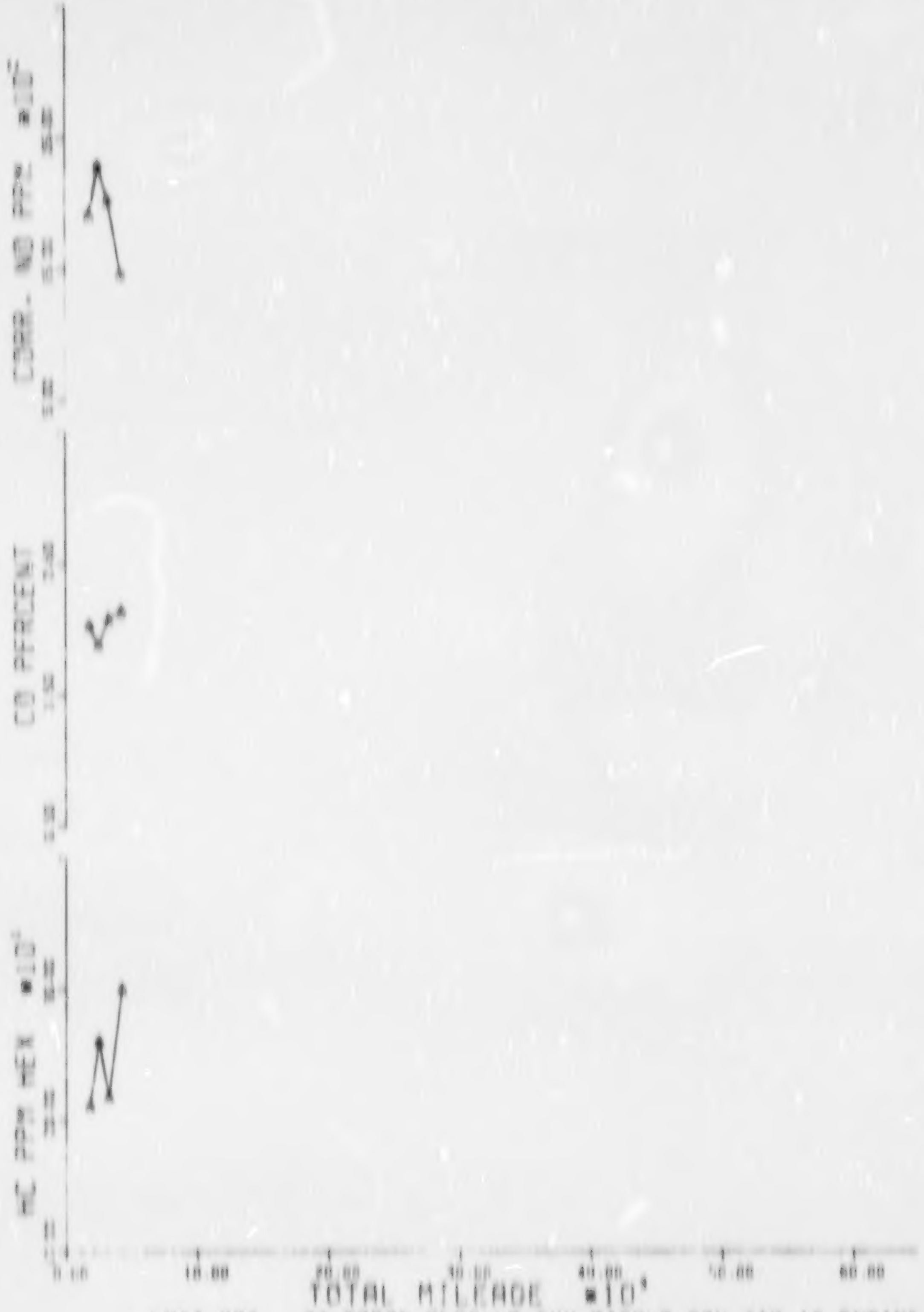
UNIT 073 TO THE 25000 LB GVW LINE 392 CID V8 ENGINE



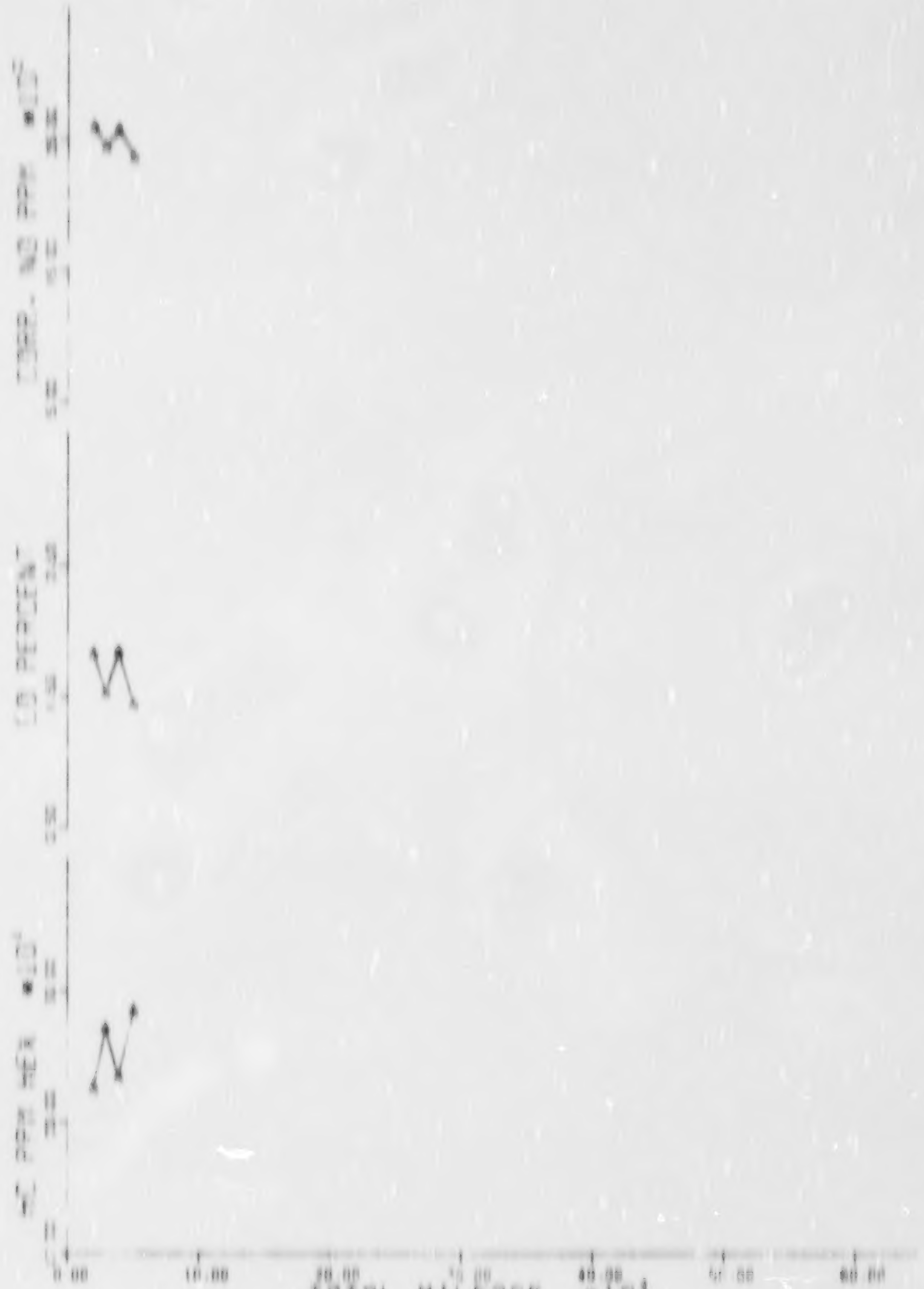
UNIT 074 70 IHC 25000 LB GVW LINE 392 CID V8 ENGINE



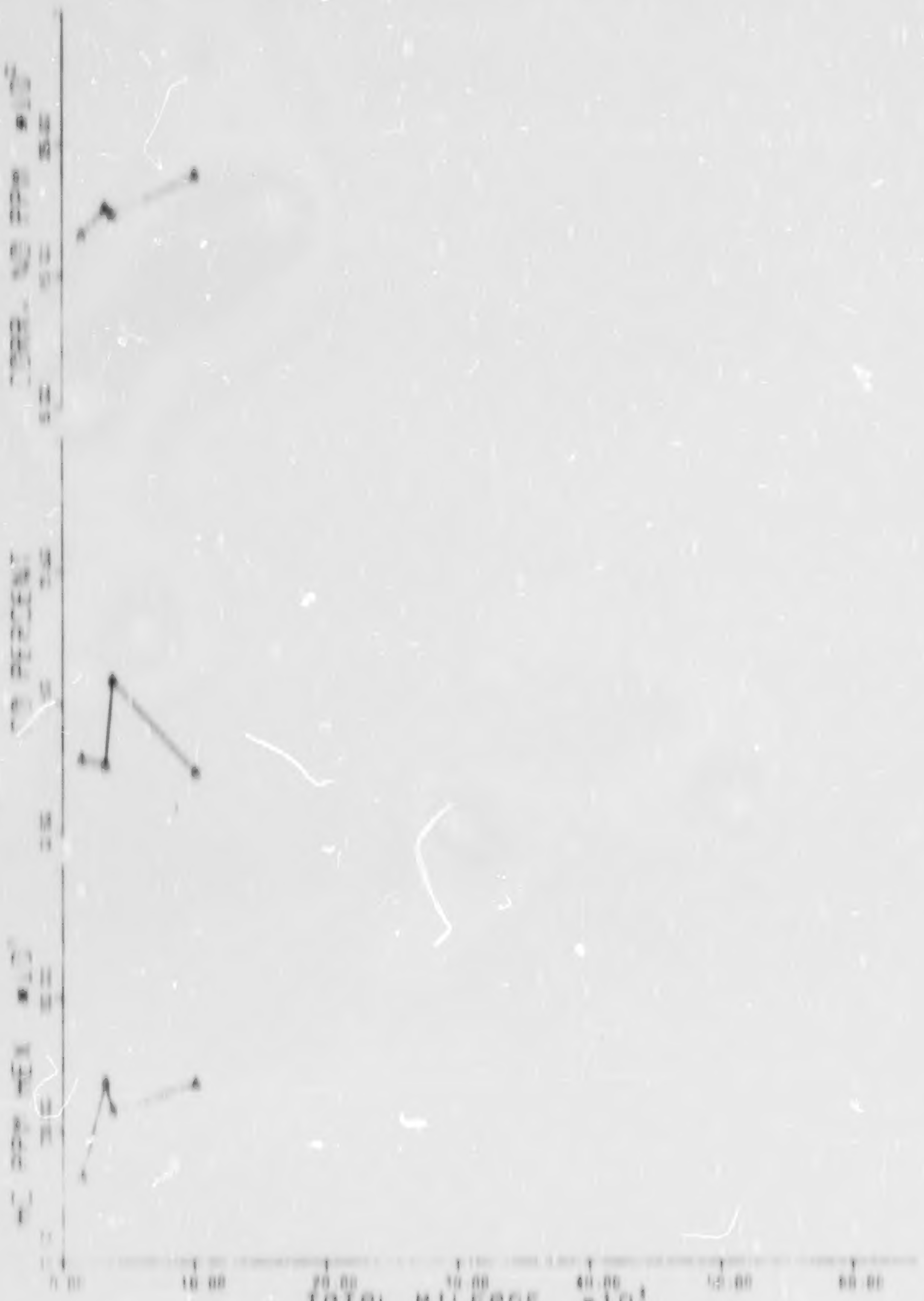
UNIT 075 70 DODGE 7500 LB GVW PICKUP 225 CID 6 ENGINE



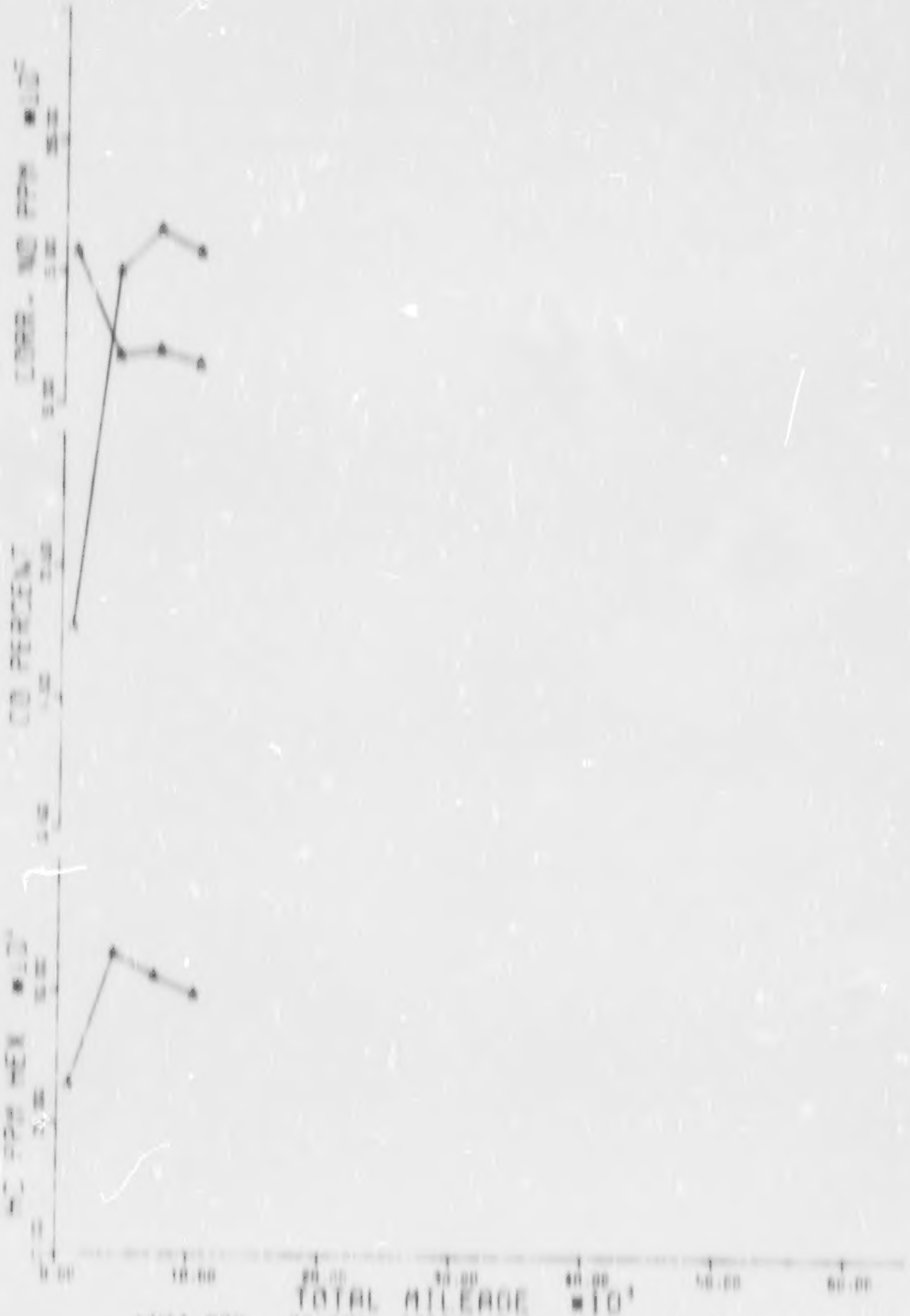
UNIT 076 73 DODGE 7500 LB GVW PICKUP 225 CID I6 ENGINE



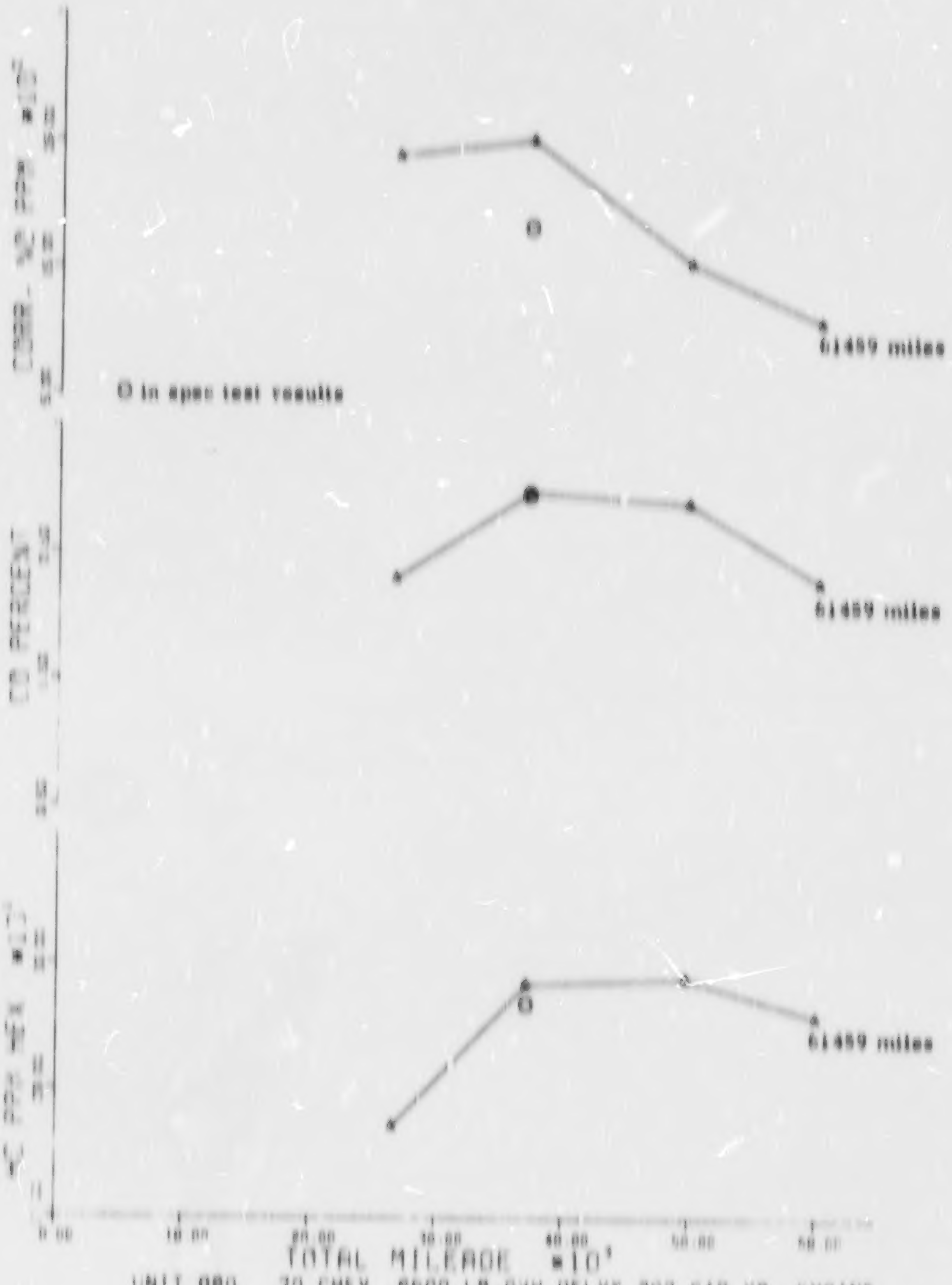
UNIT 077 76 DODGE 7500 LB GVW PICKUP 225 CID I6 ENGINE



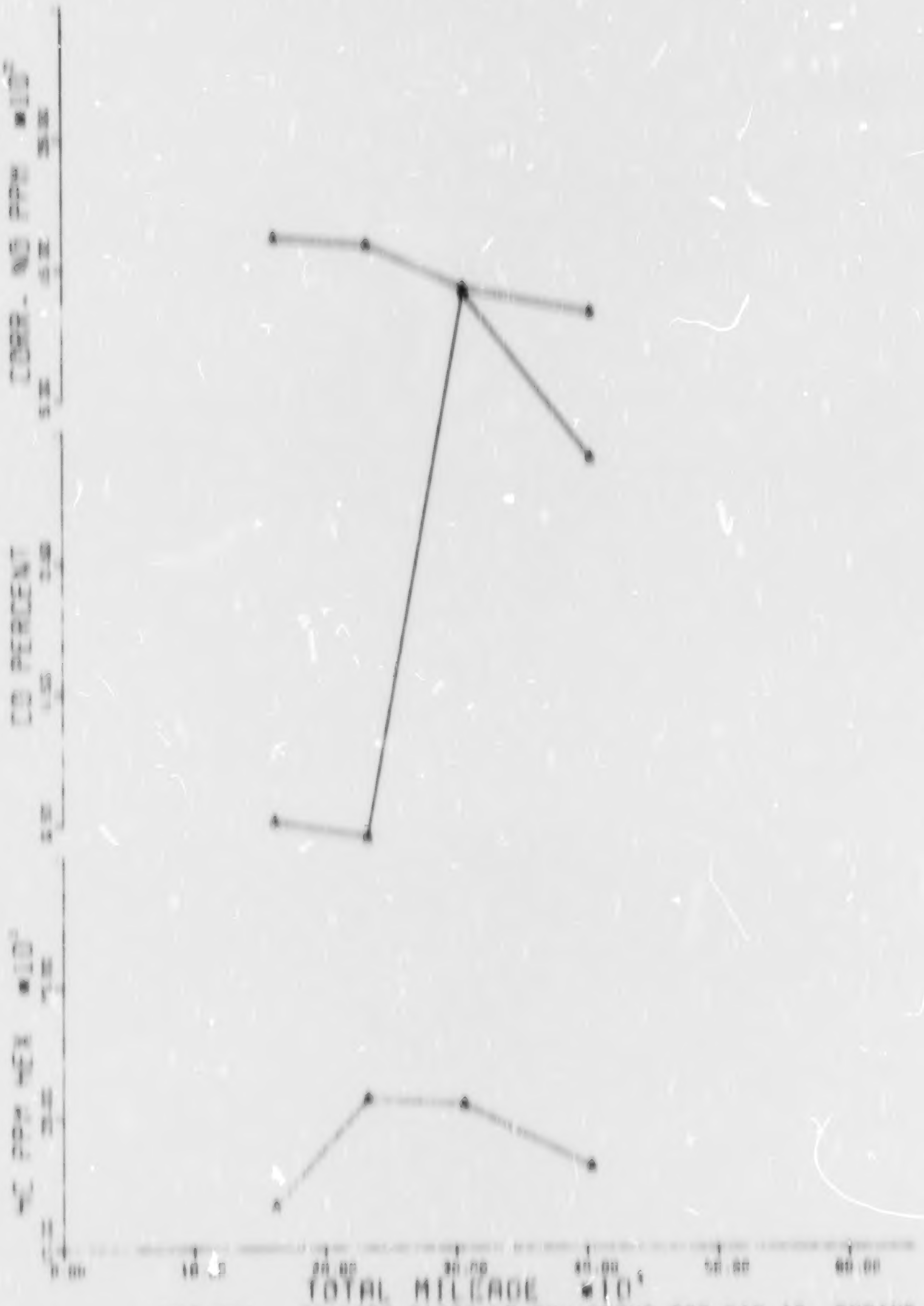
UNIT 078   70 FORD 6800 LB GVW VAN   302 CID V8 ENGINE



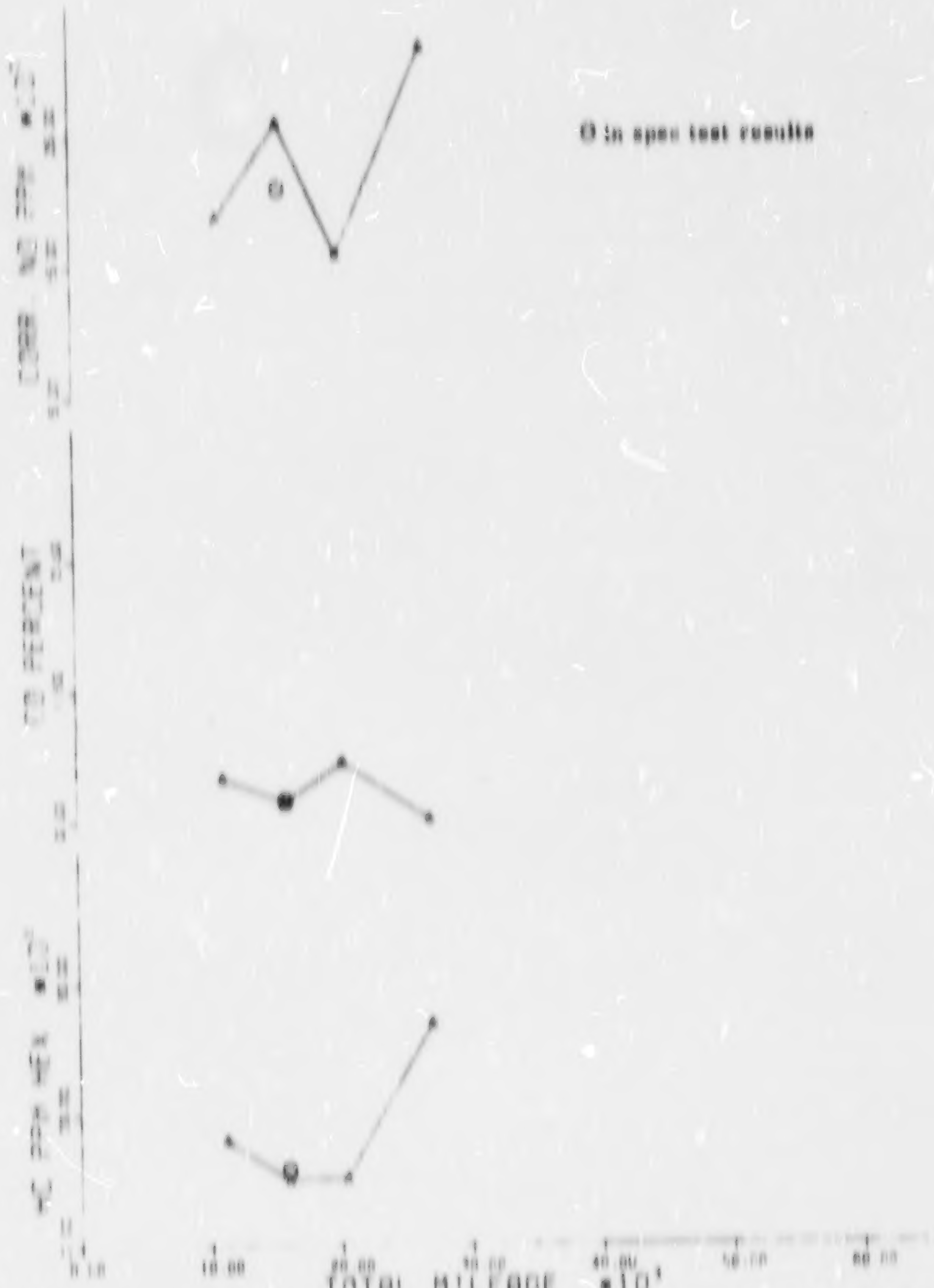
UNIT 079 70 GMC 27000 LB GVW BUS 401 CID V6 ENGINE



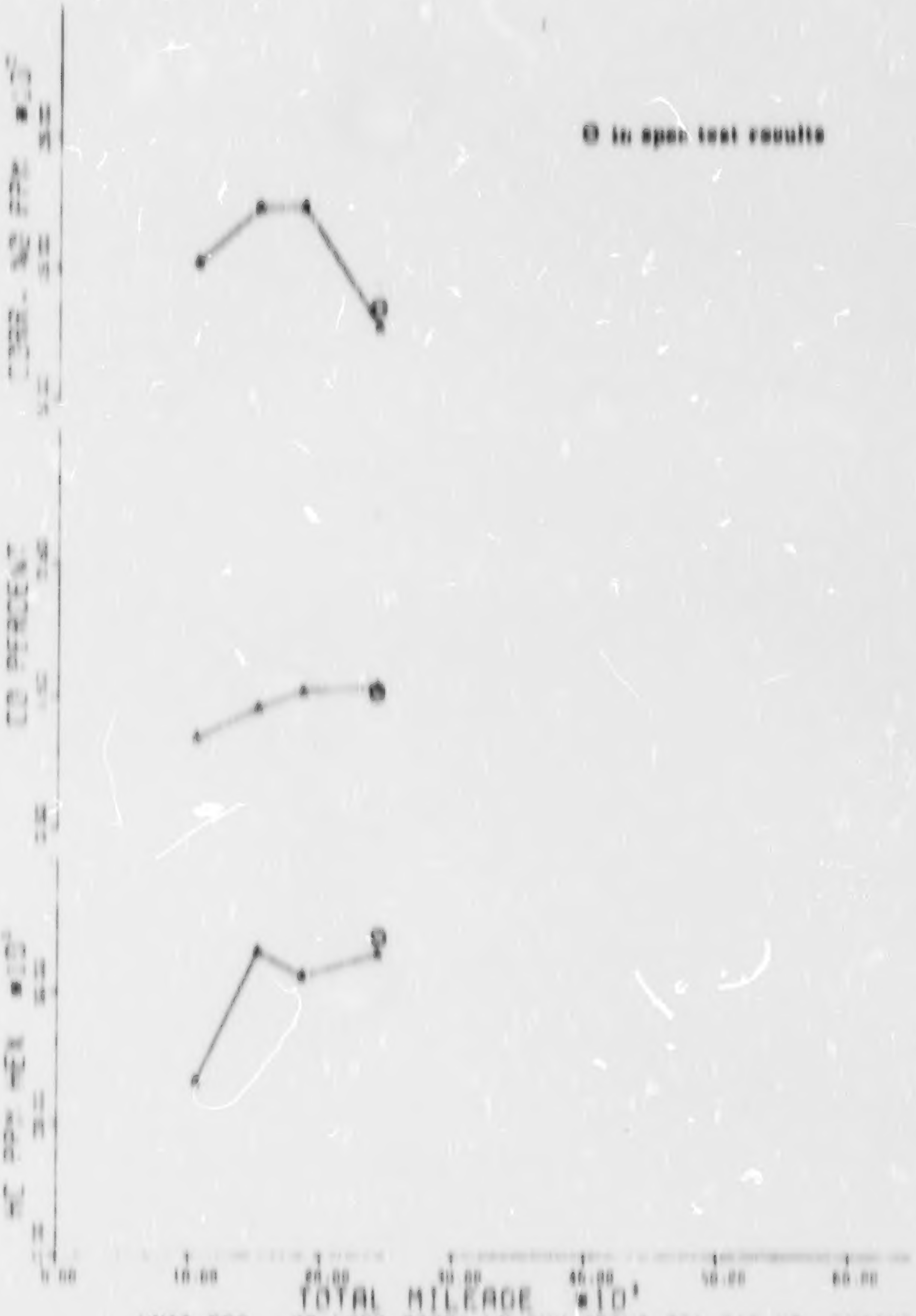
UNIT 080 70 CHEV 6600 LB GVW DELVY 307 CID V8 ENGINE



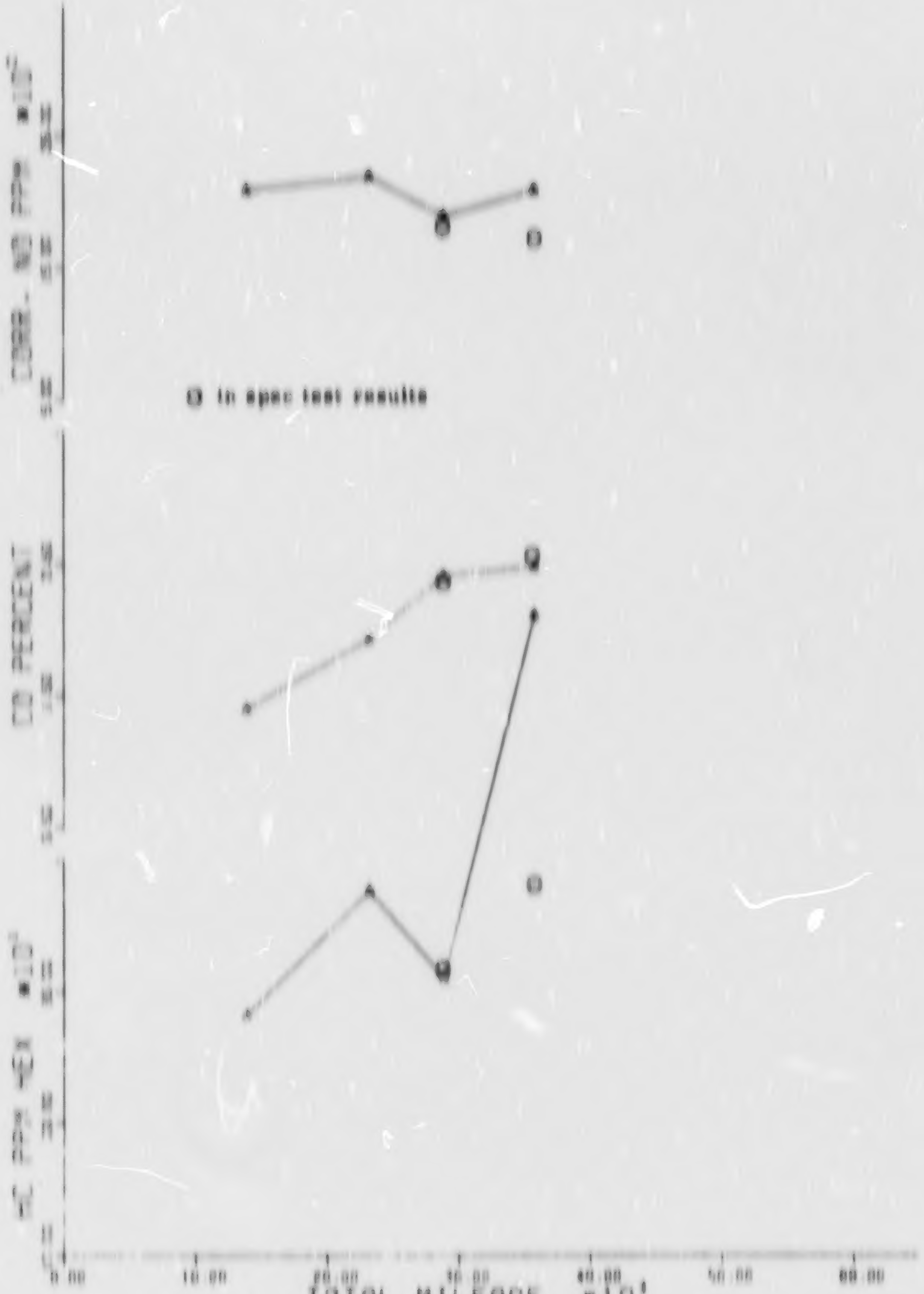
UNIT 0A1 70 FORD 21000 LB GVW FRONT 300 CID I6 ENGINE



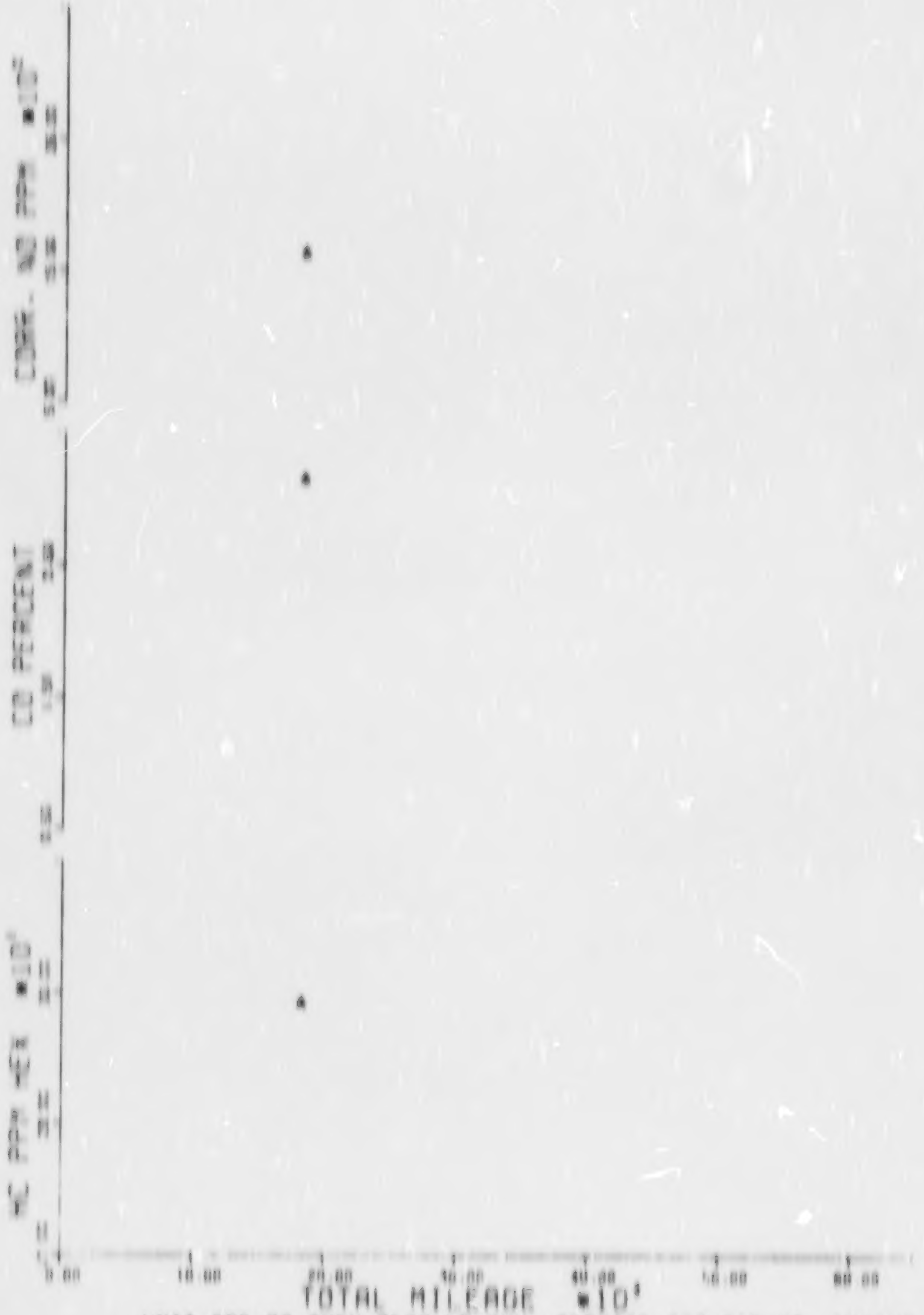
UNIT 98F 70 FORD 21000 LB GVW FRONT 300 CID 16 ENGINE



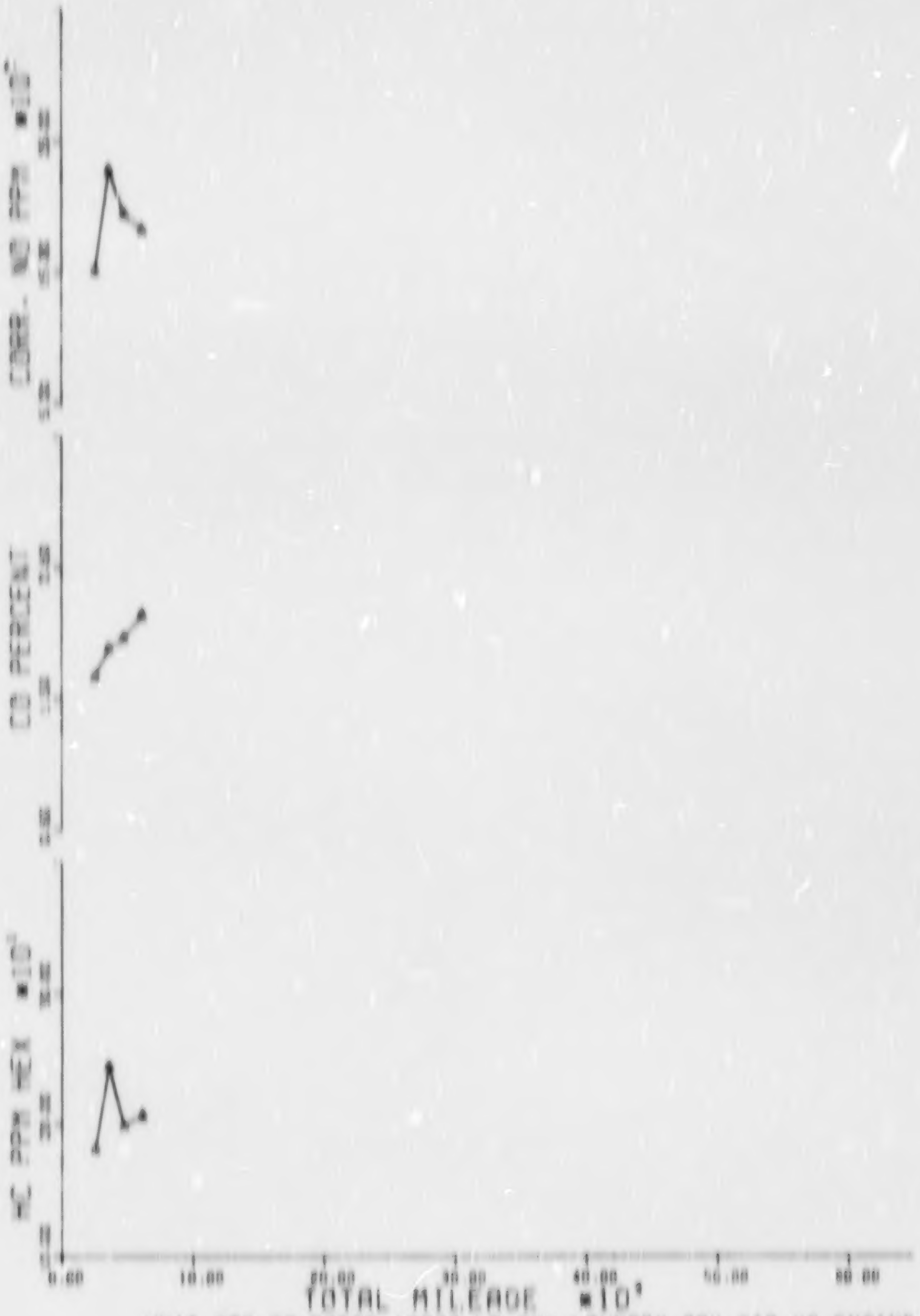
UNIT 083   70 FORD 22000 LB GVW FRGHT 361 CID V8   ENGINE



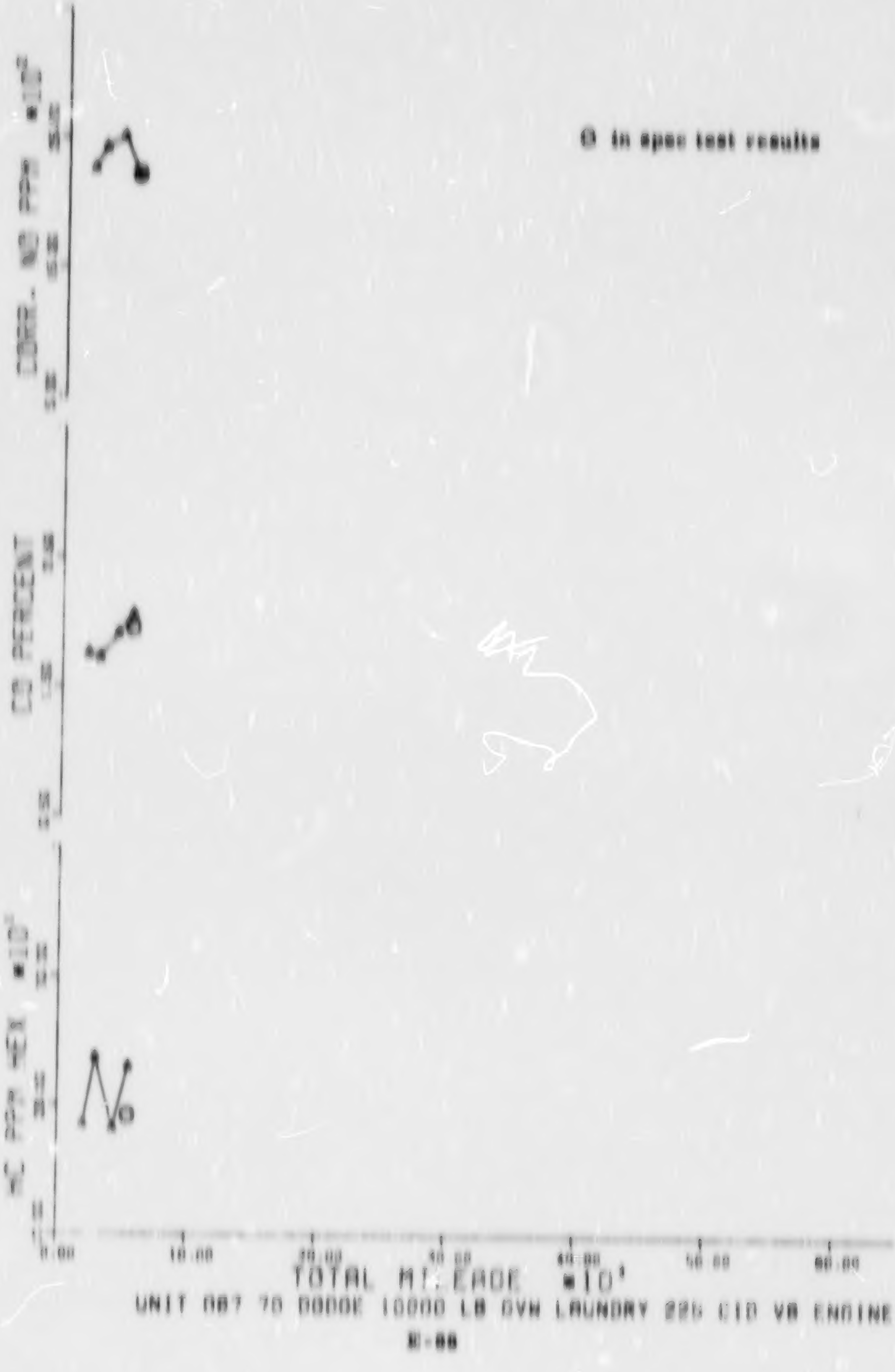
UNIT 084 78 FORD 22030 LB GVW FRONT 361 CID V8 ENGINE



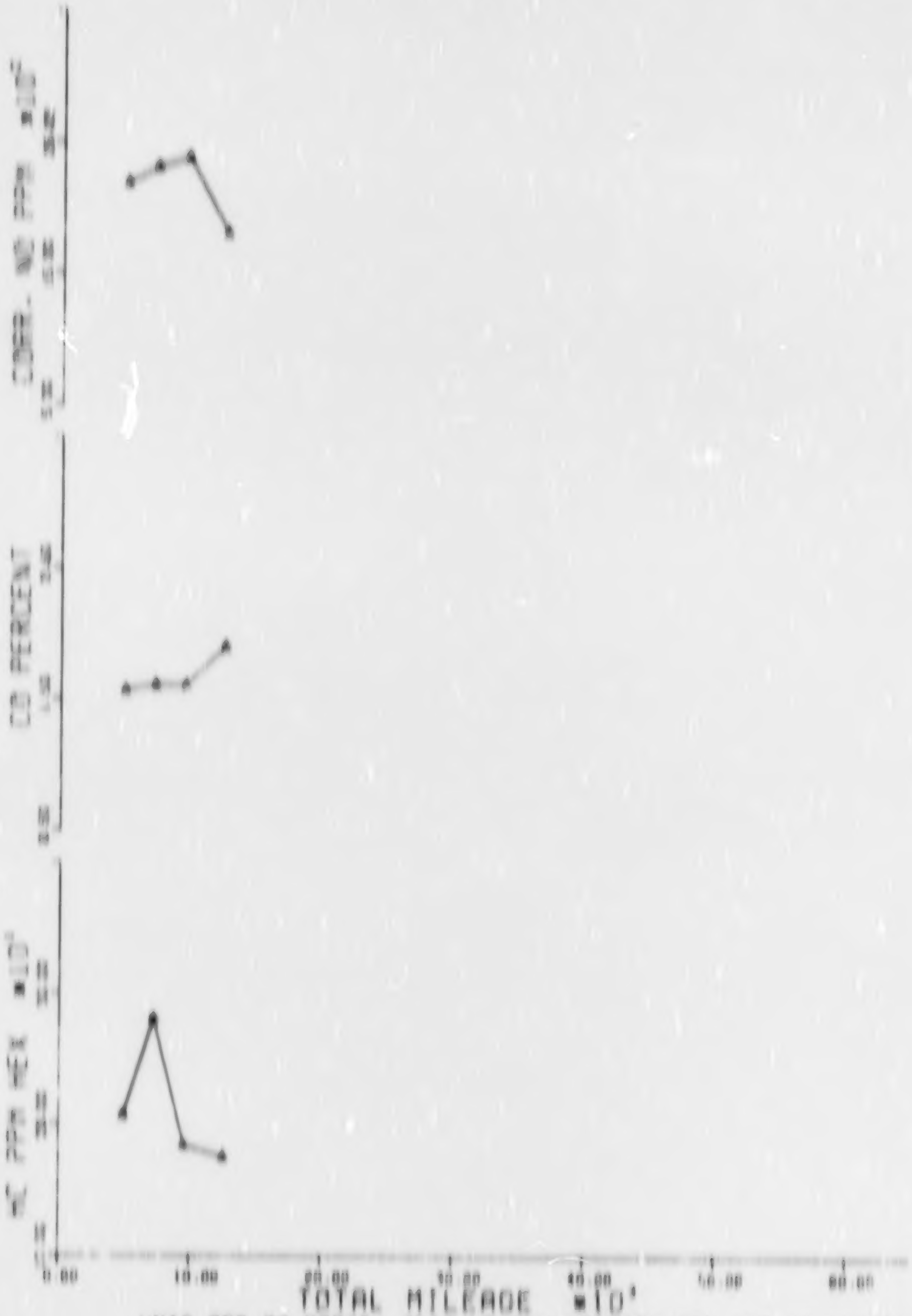
UNIT 085 70 CHEV 7500 LB GVW SERVICE 307 CID V8 ENGINE



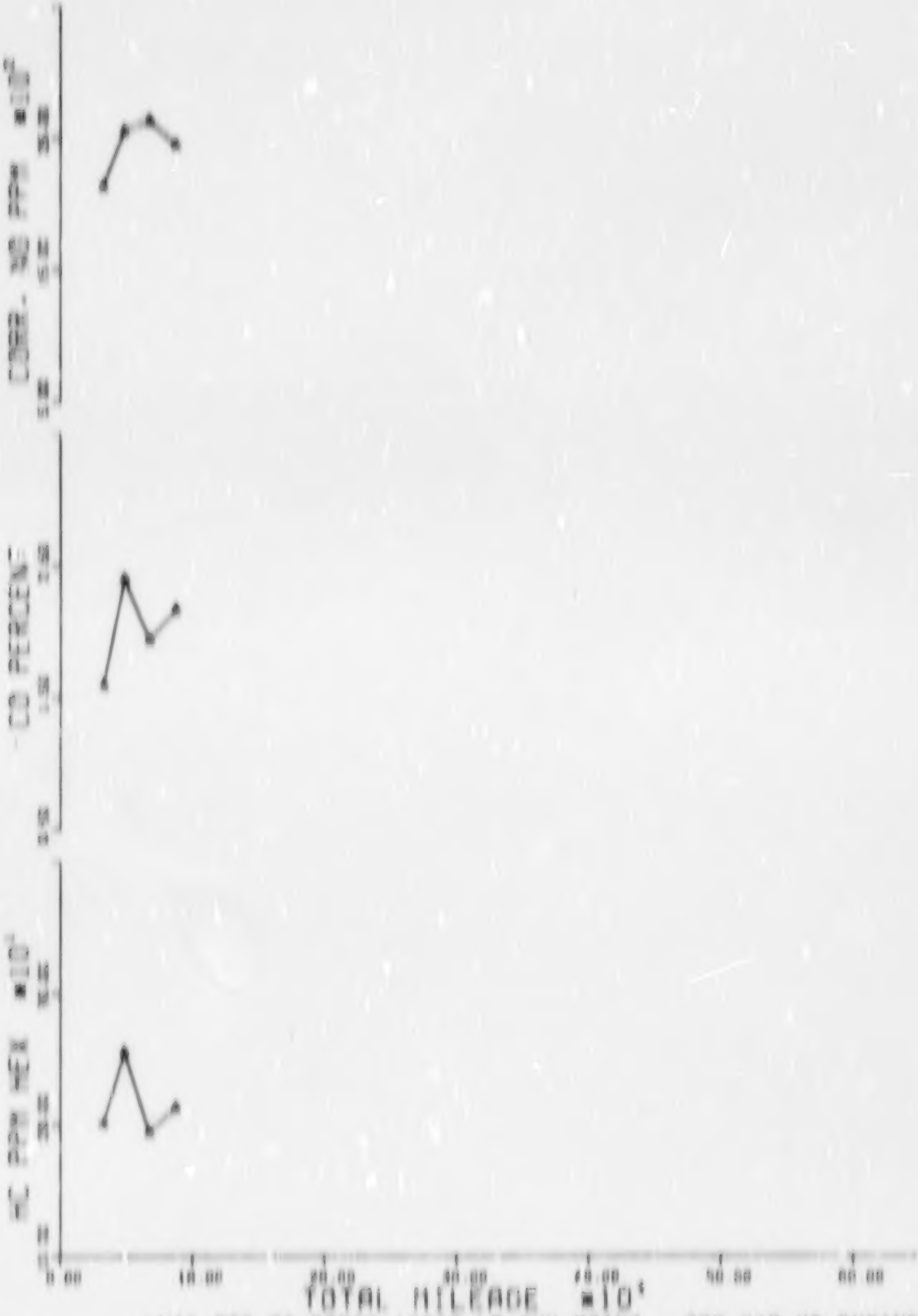
UNIT 086 70 DODGE 10000 LB GVW LAUNDRY 225 CID V8 ENGINE



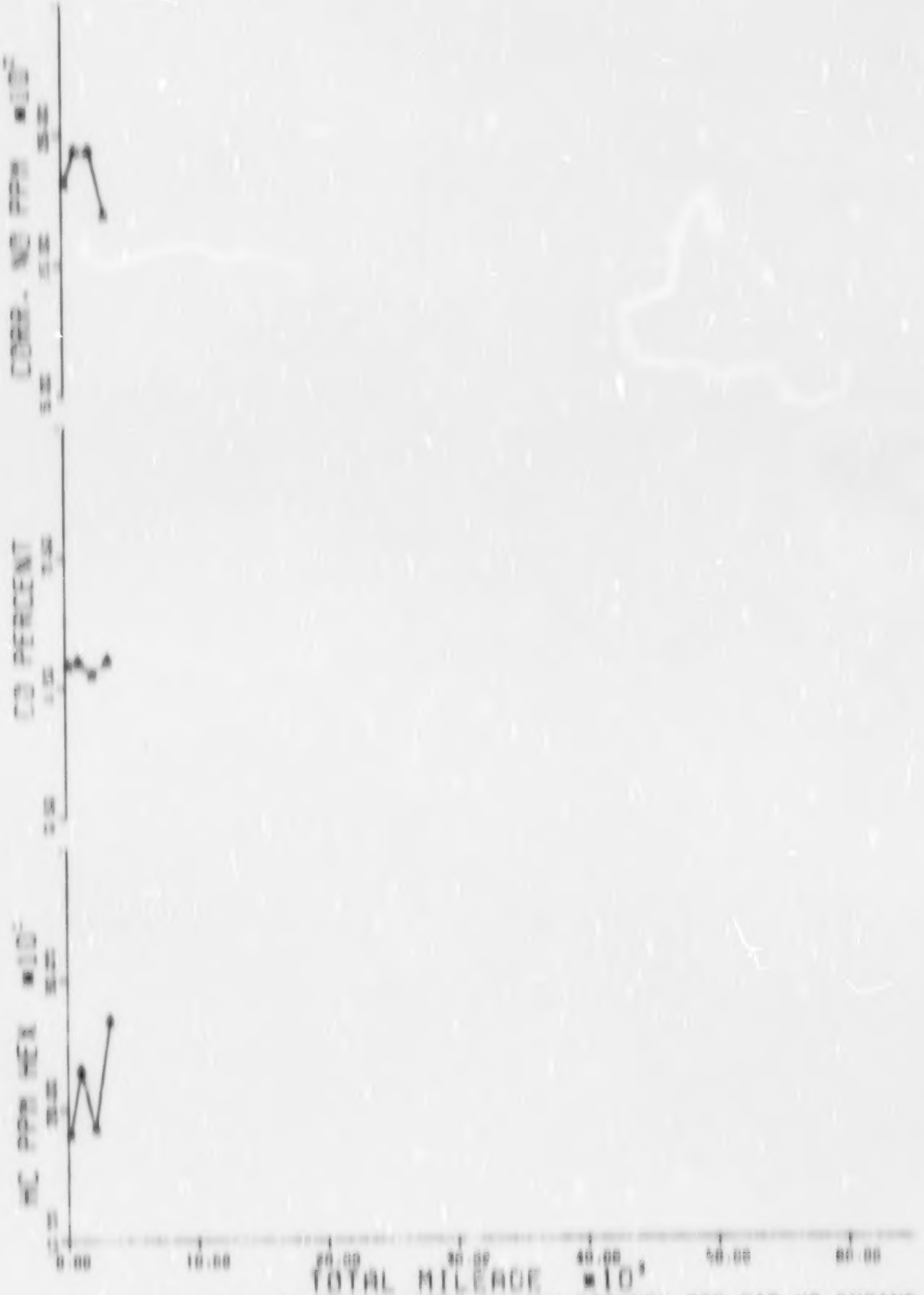
UNIT 087 70 DODGE 10000 LB GVW LAUNDRY 225 CID V8 ENGINE



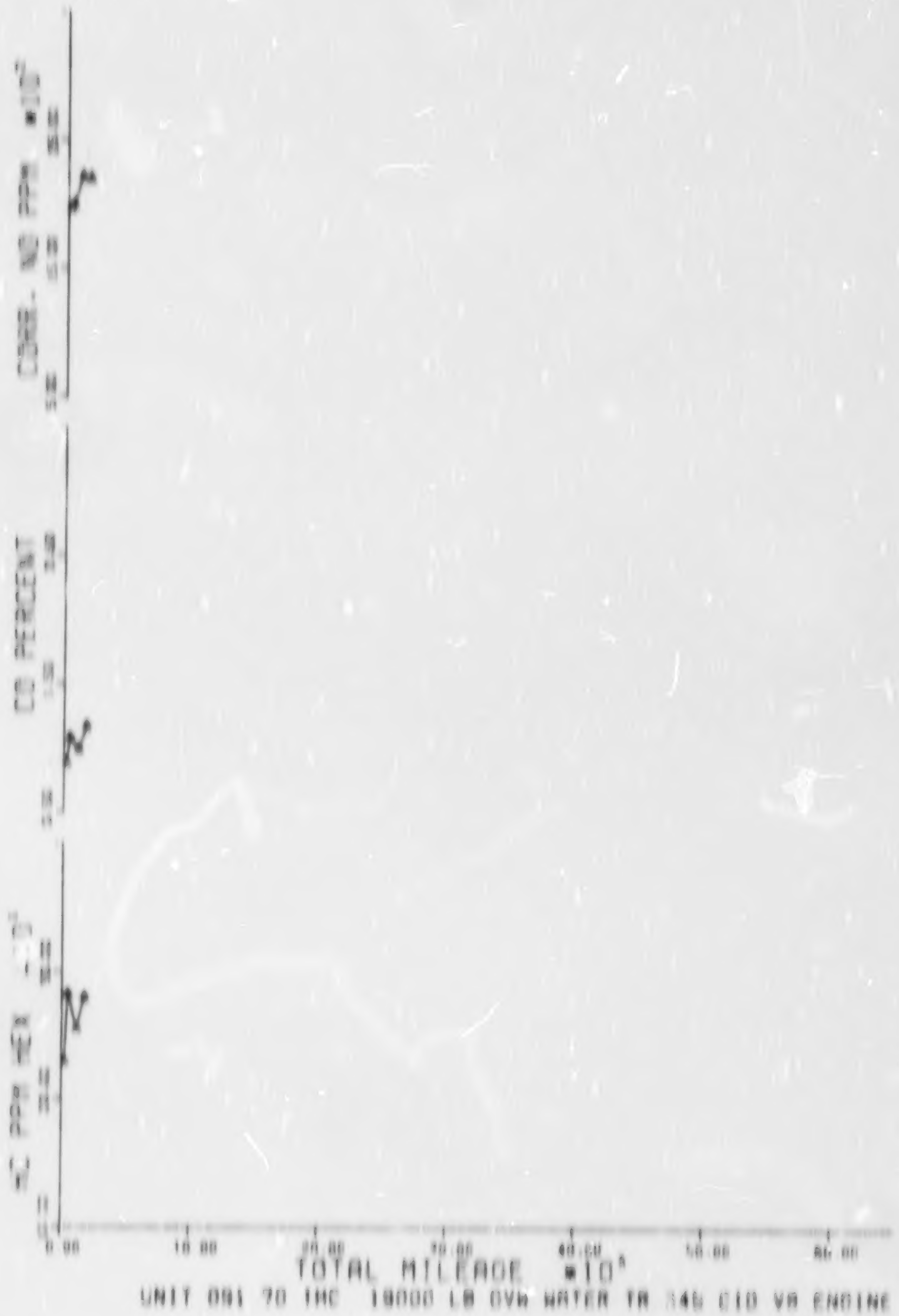
UNIT 088 70 DODGE 7500 LB GVW LAUNDRY 225 CID V8 ENGINE



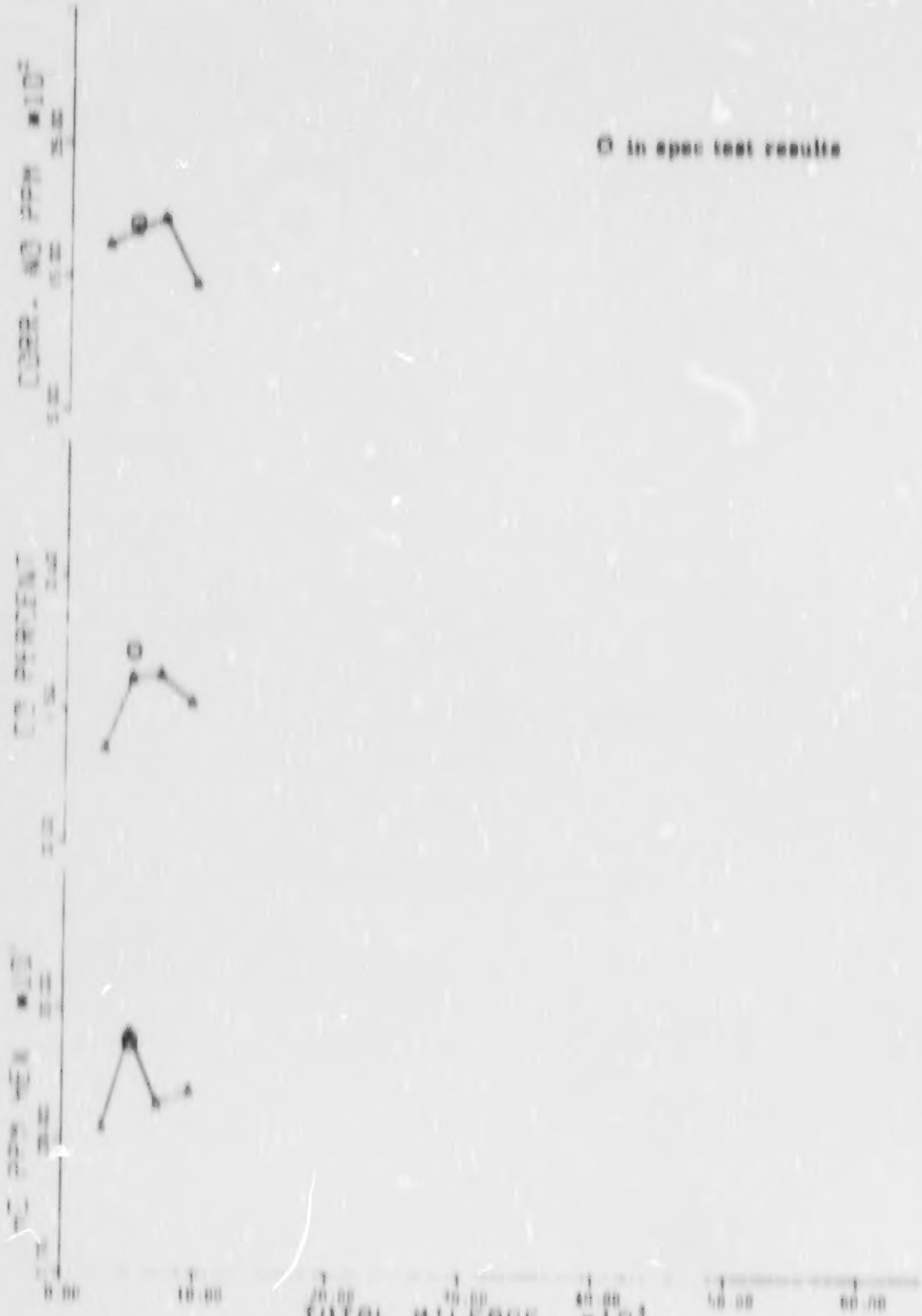
UNIT 089 70 DODGE 10000 LB GVW MAINT. 225 CID V8 ENGINE



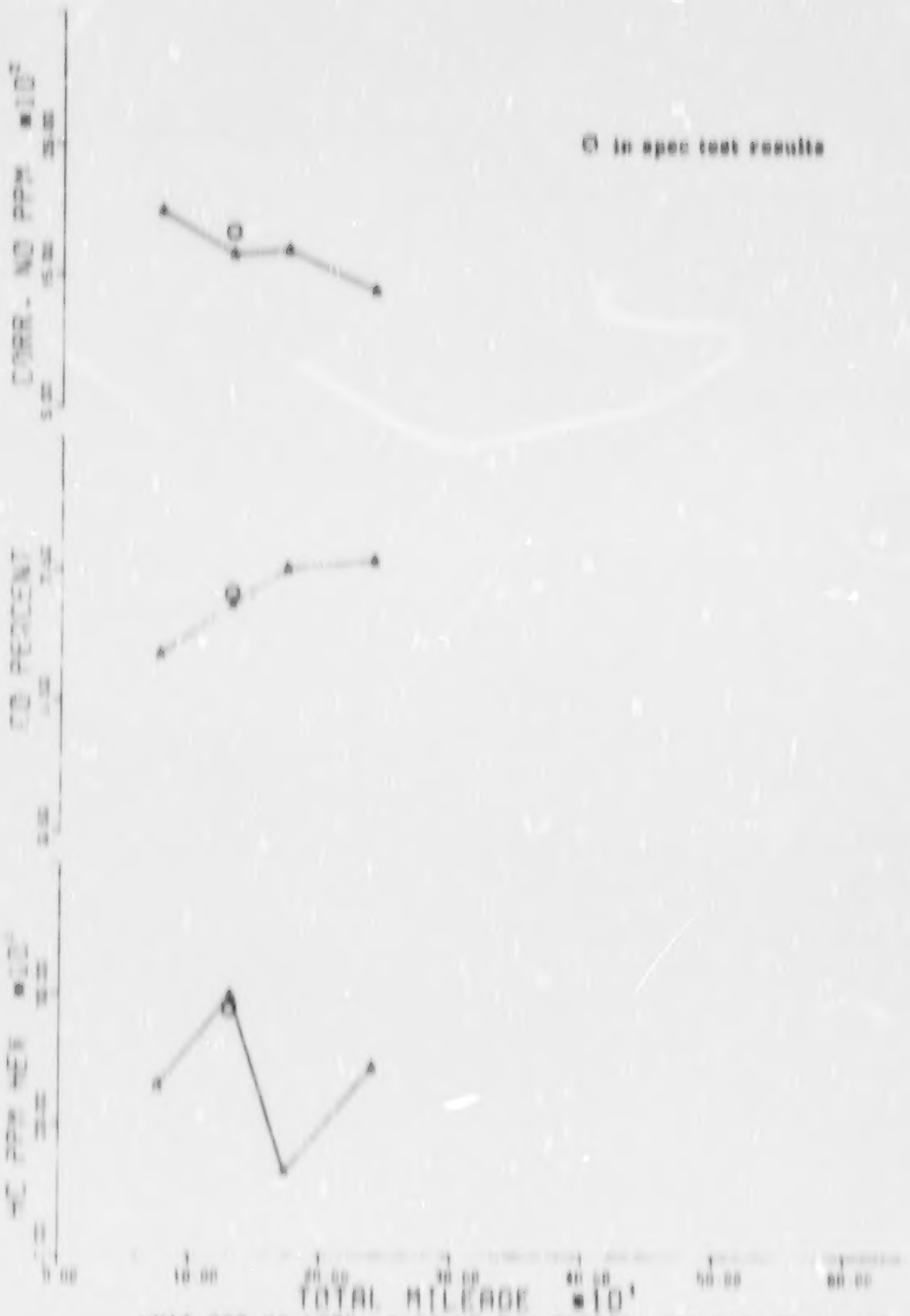
UNIT 080 70 DODGE 10000 LB GVW GROUNDS 225 CID V8 ENGINE



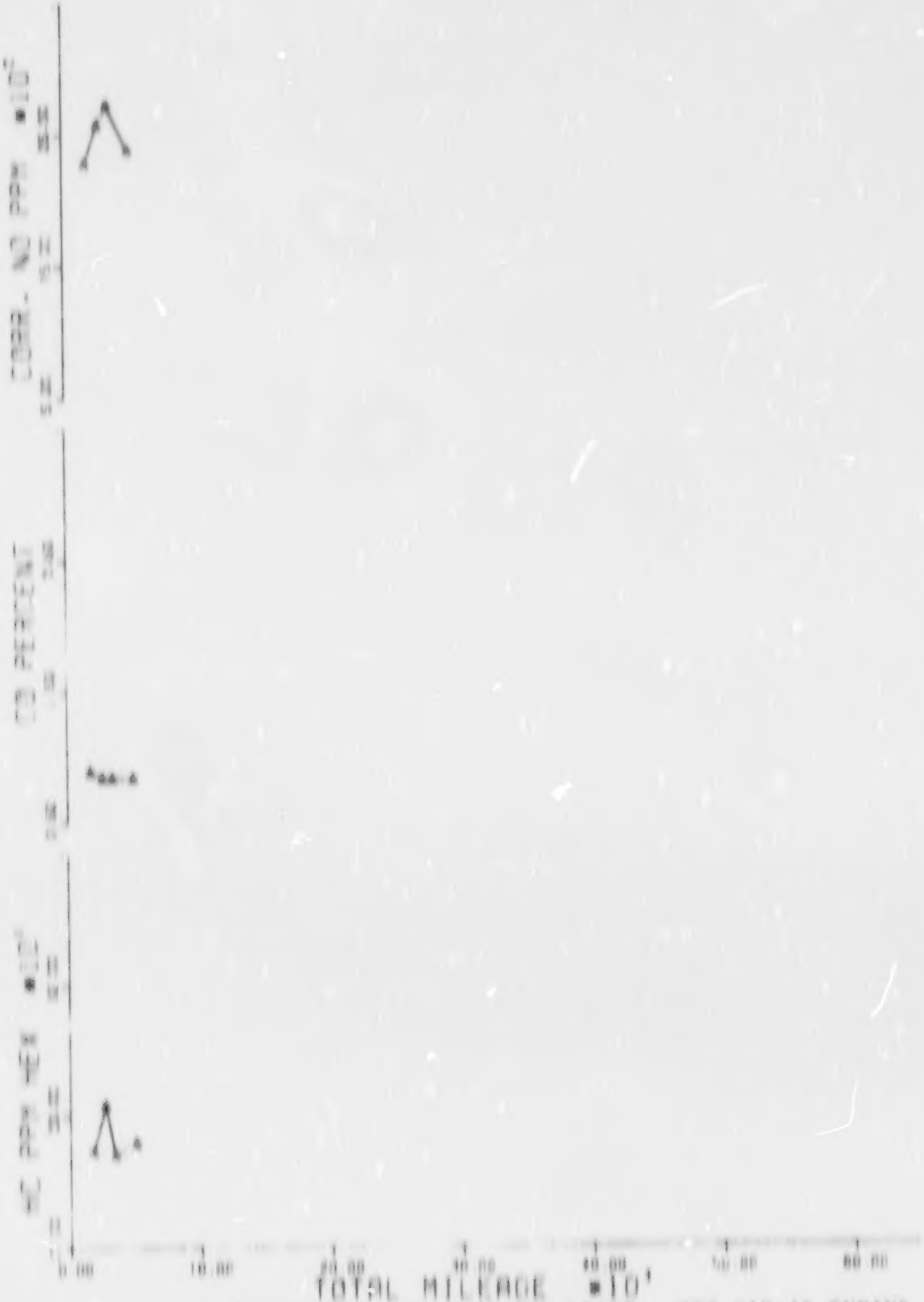
UNIT 091 70 IHC 19000 LB GVW WATER TR 345 CID V8 ENGINE



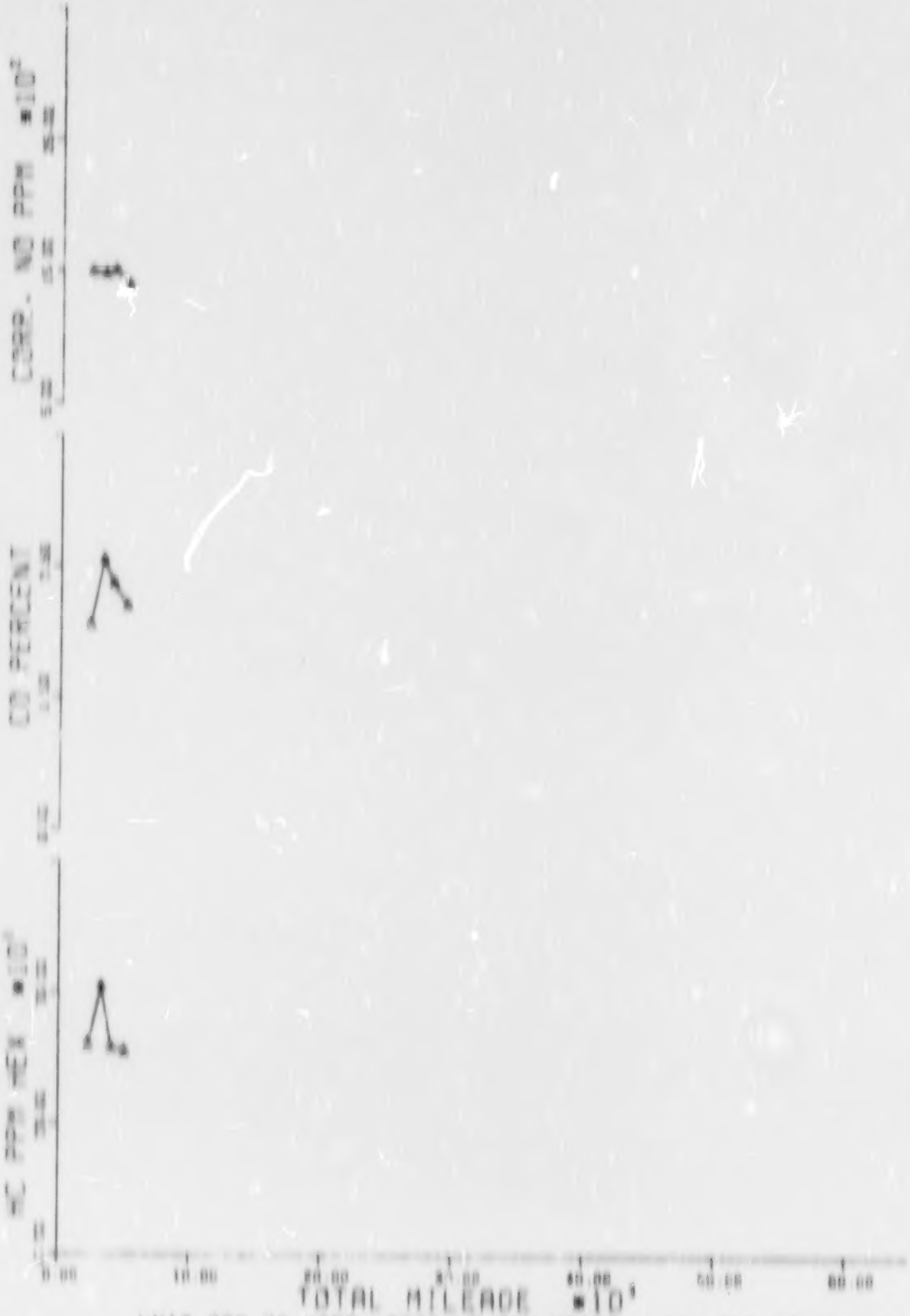
UNIT 082 TO FORD 8300 LB GVW MAINT. 360 CID V8 ENGINE



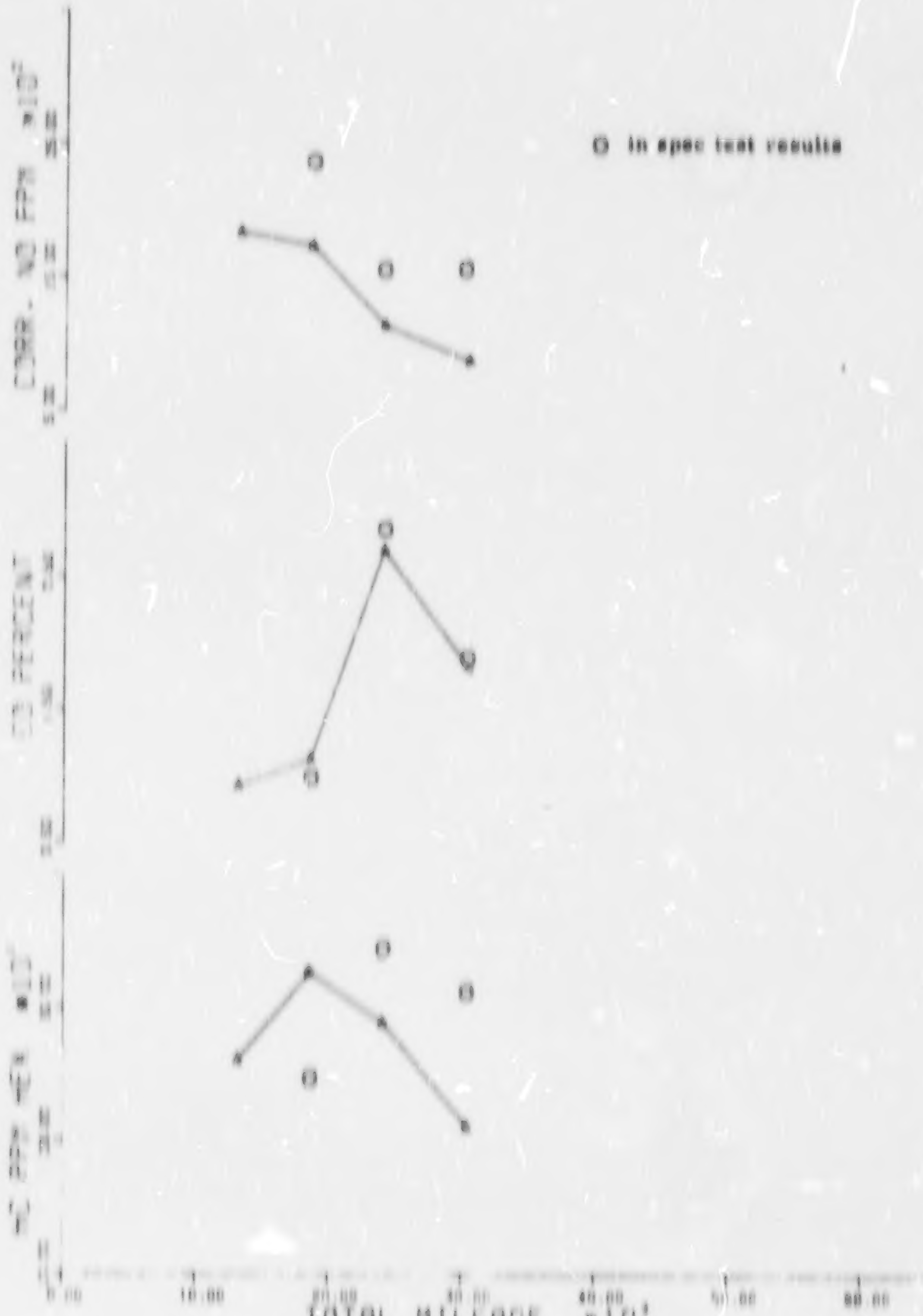
UNIT 095 70 FORD 7500 LB GVW REPAIR 360 CID V8 ENGINE



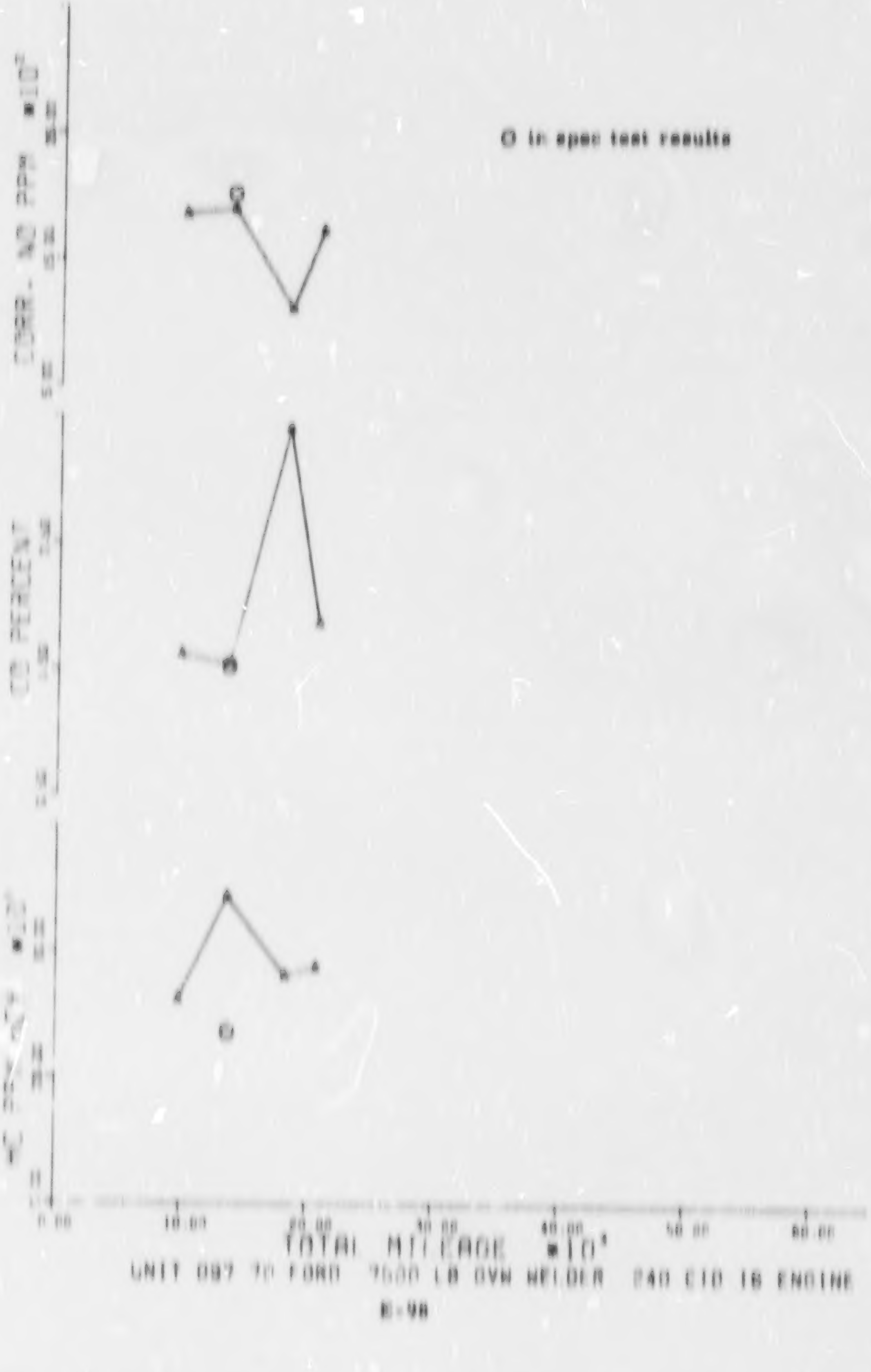
UNIT 004 70 CHEV 14000 LB GVW MAINT. 292 CID I6 ENGINE



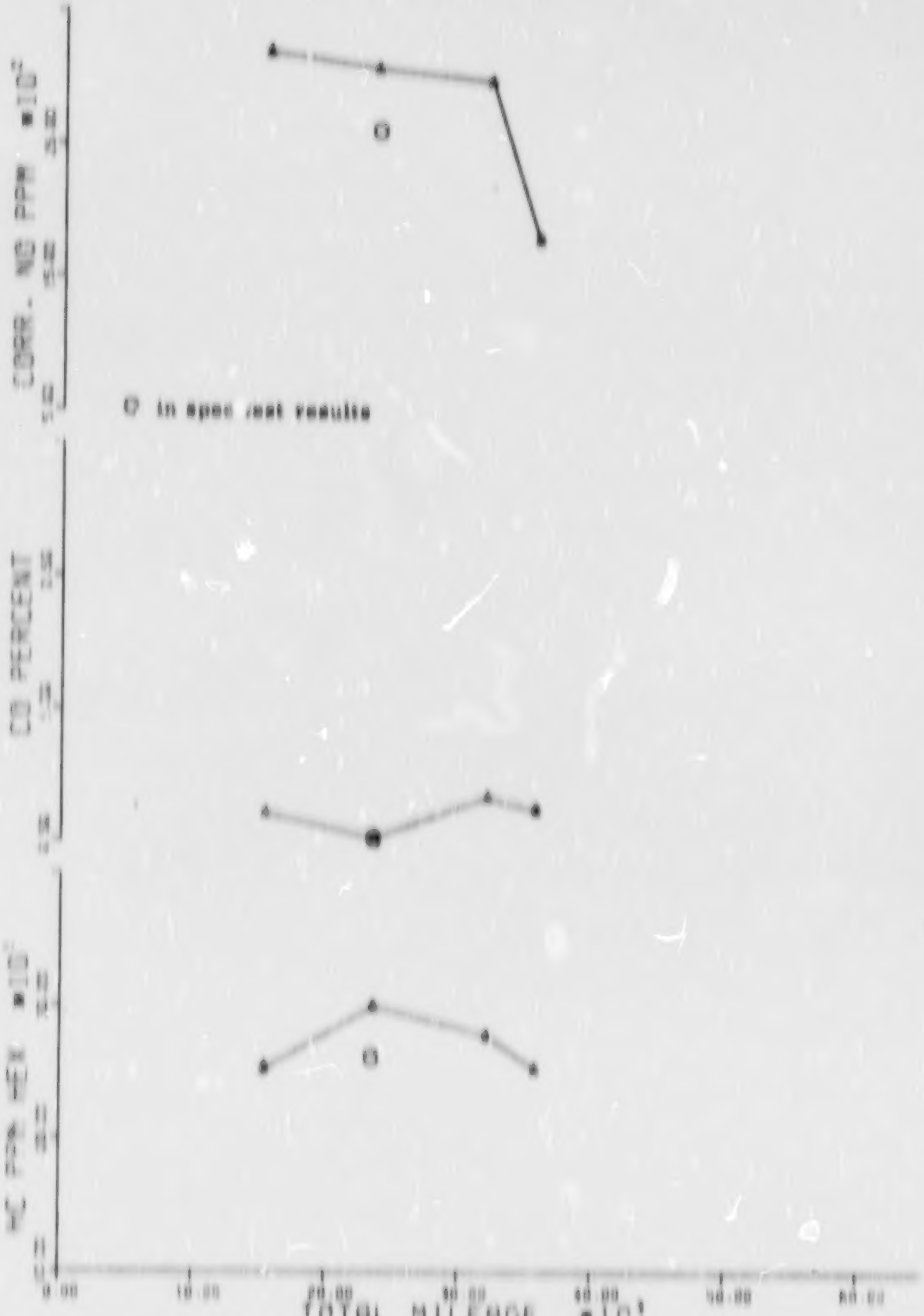
UNIT 095 70 FORD 8300 LB GVW MAINT. 360 CID V8 ENGINE



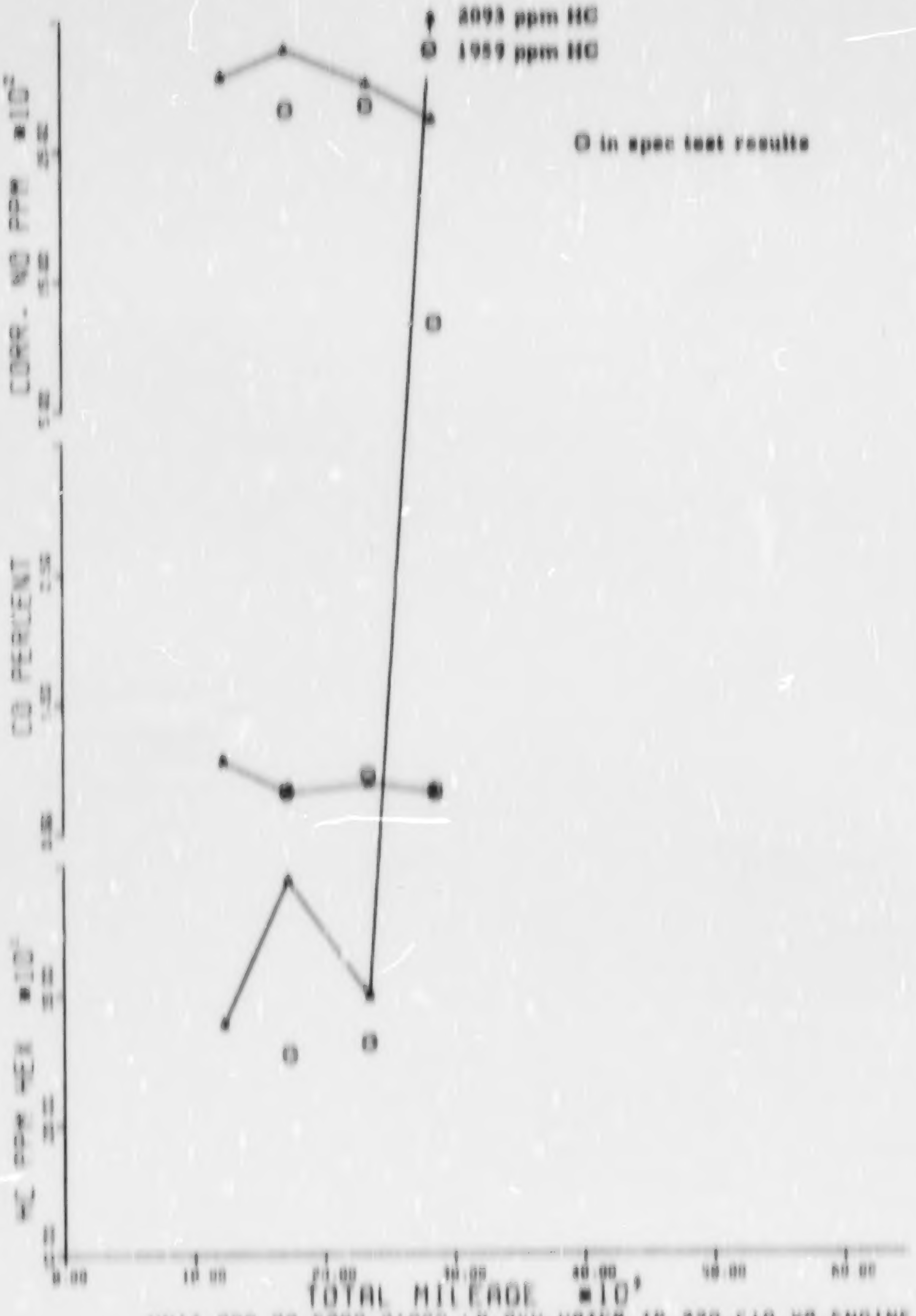
UNIT 098 70 FORD 7000 LB GVW MAINT. 240 CID I6 ENGINE



UNIT 097 70 FORD 7500 LB GVW WELDER 240 CID I6 ENGINE

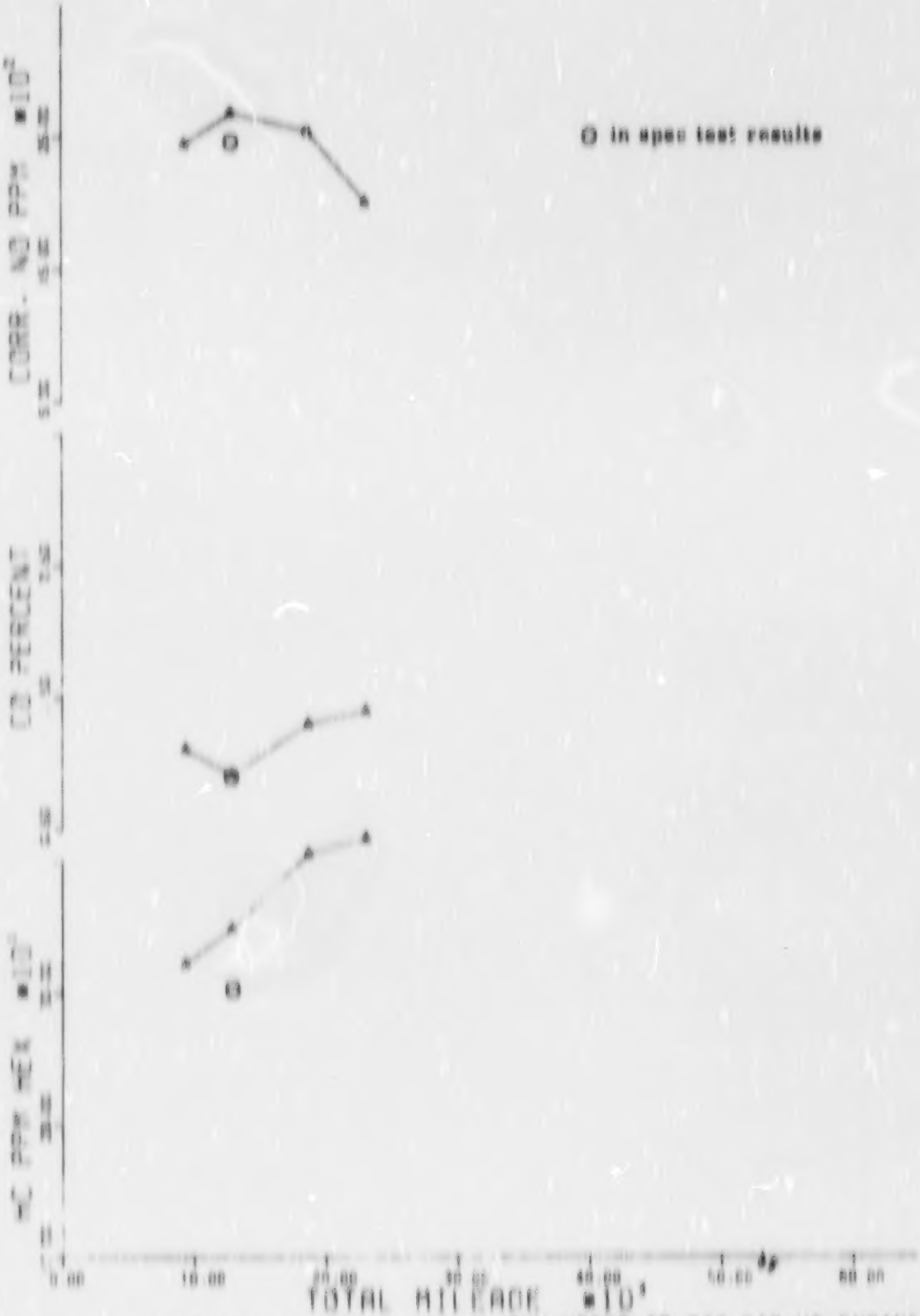


UNIT 098 70 FORD 21000 LB GVW WATER TR 330 CID V8 ENGINE

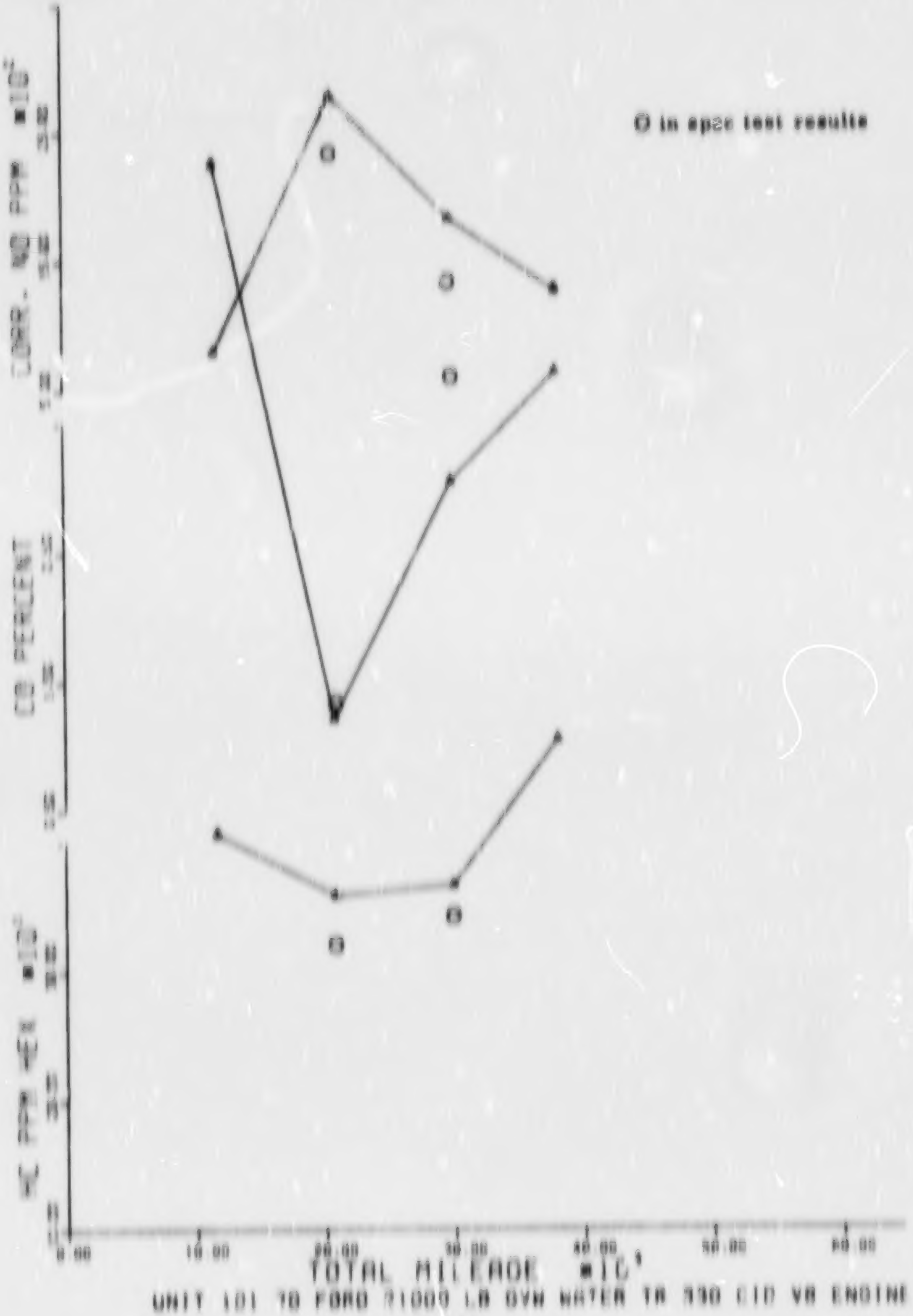


UNIT 098 70 FORD 21000 LB GVW WATER TR 330 CID V8 ENGINE

E-100

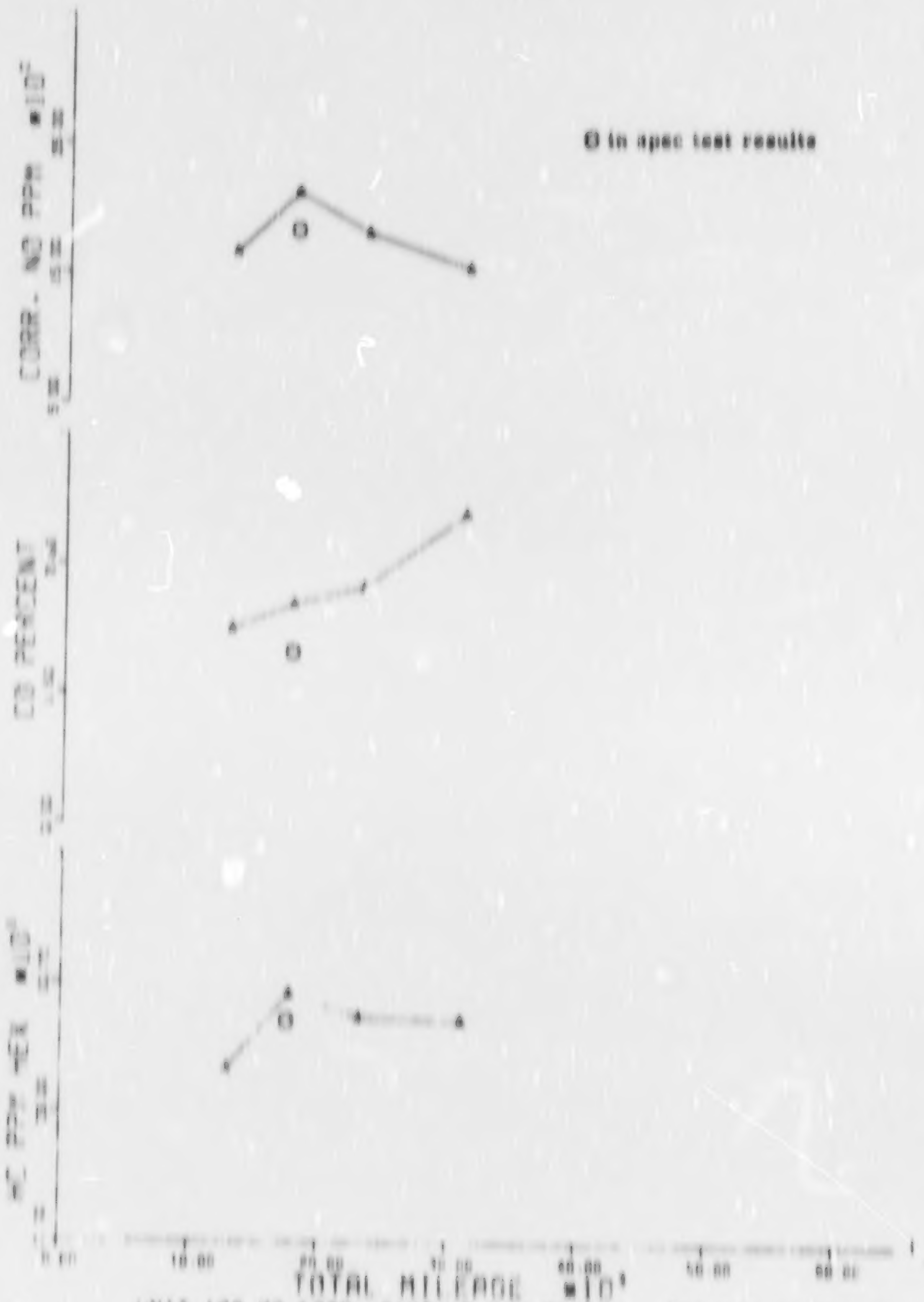


UNIT 100 70 FORD 21000 LB GVW WATER TR 330 CID V8 ENGINE

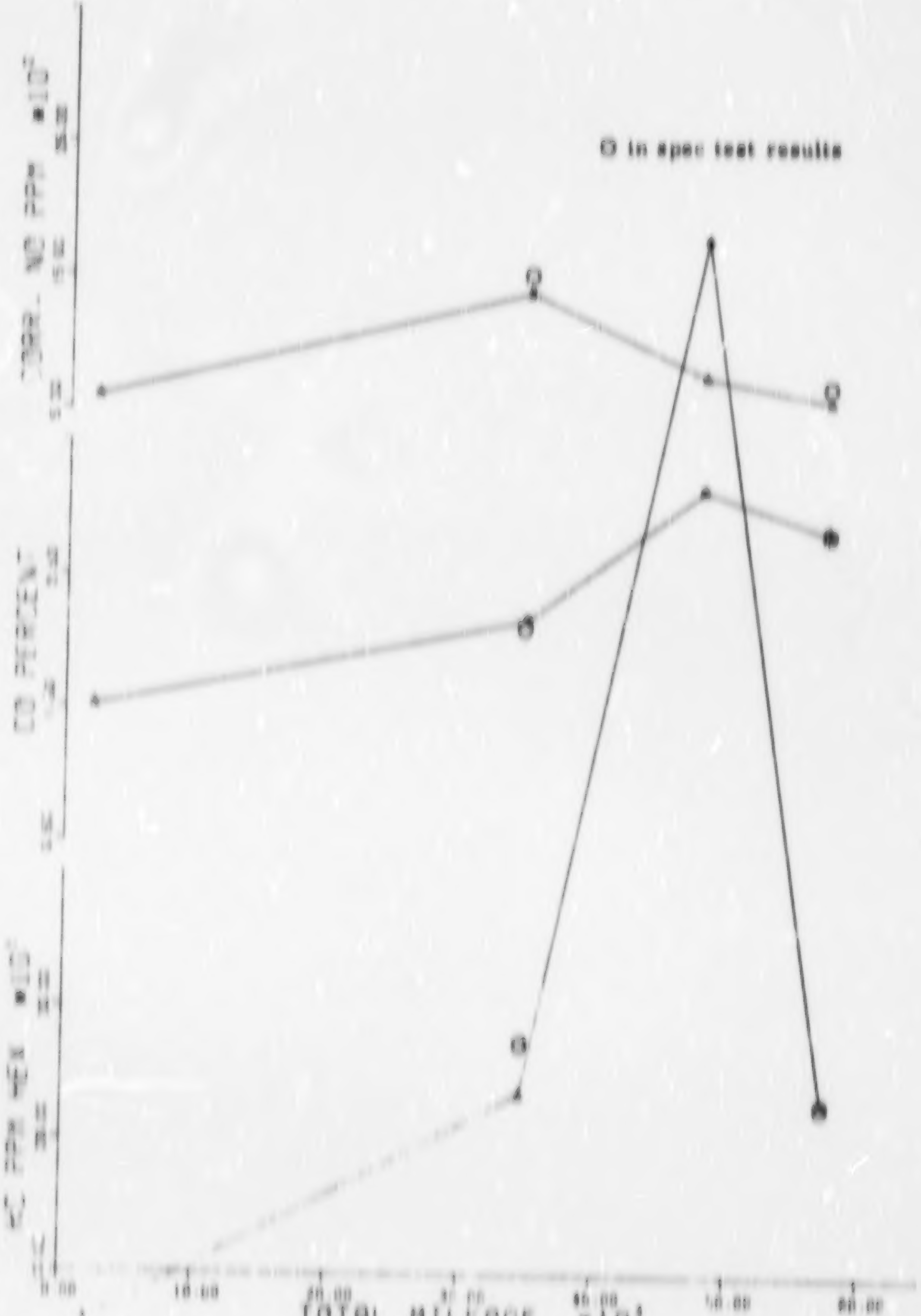


UNIT 101 TO FORD 31000 LB GVW WATER TR 330 CID V8 ENGINE

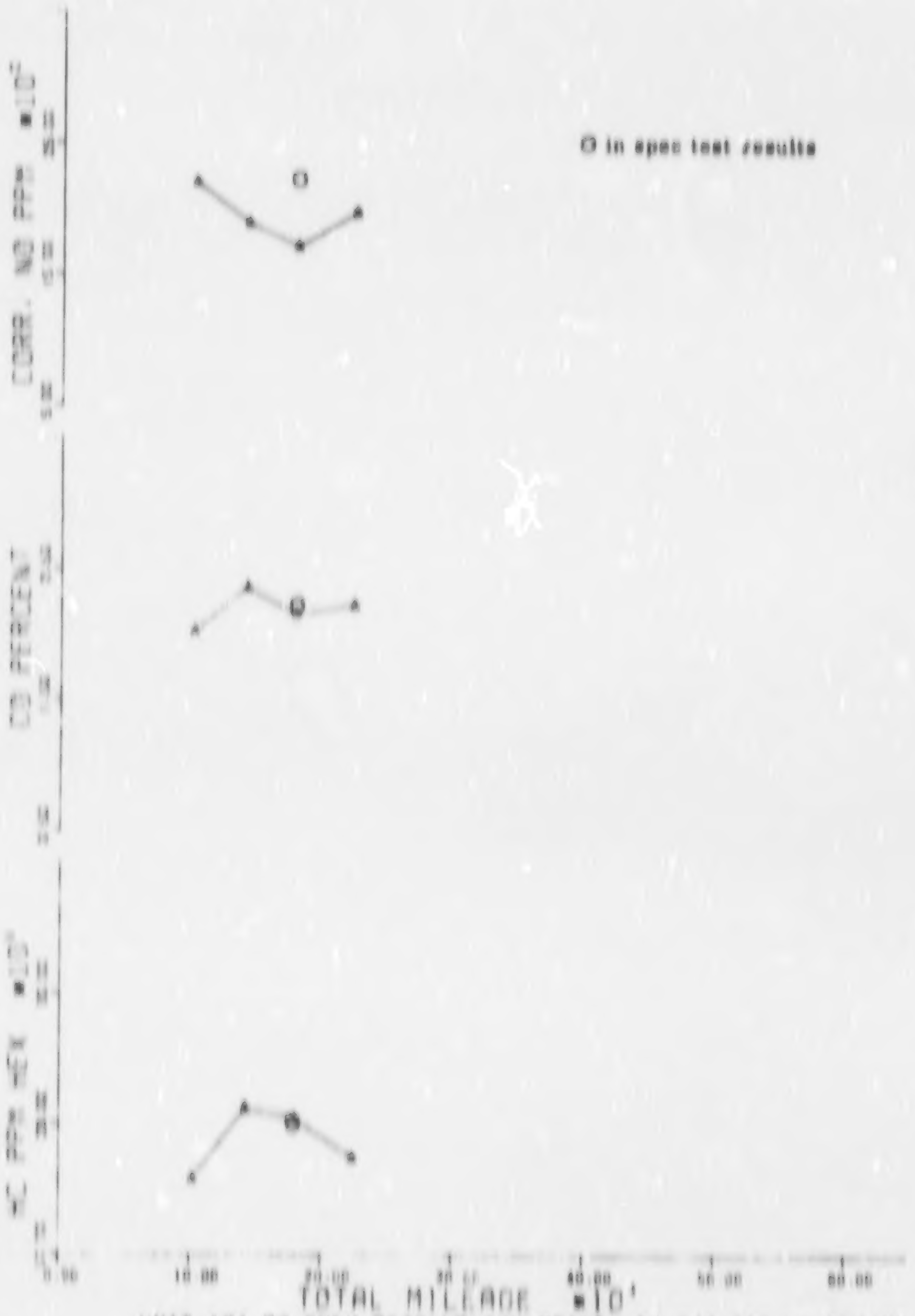
E-102



UNIT 102 70 FORD 8100 LB GVW MAINT.   360 CID V8 ENGINE

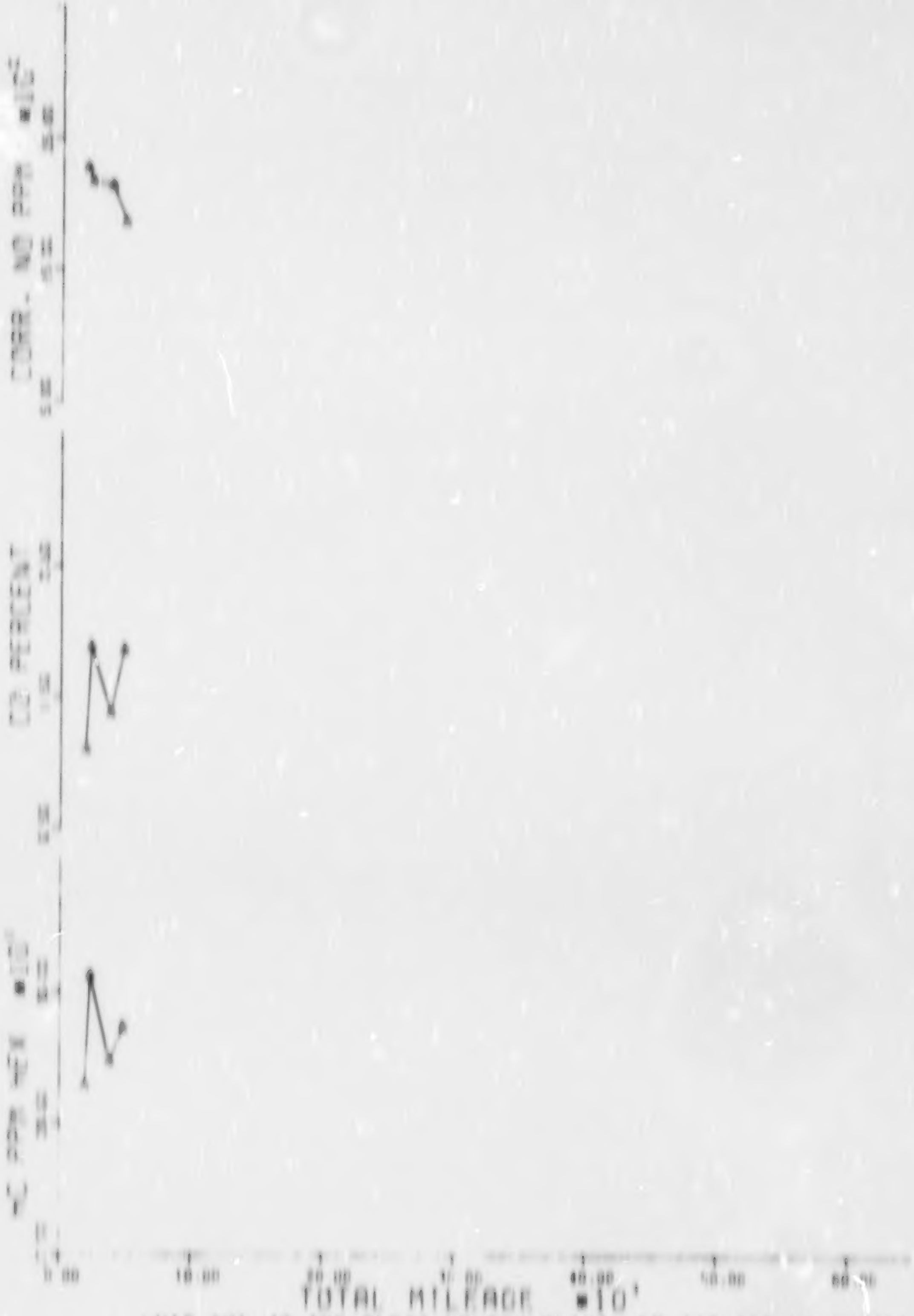


UNIT 103 '75 GMC 12500 LB GVW MOVING TR 427 CID V8 ENGINE

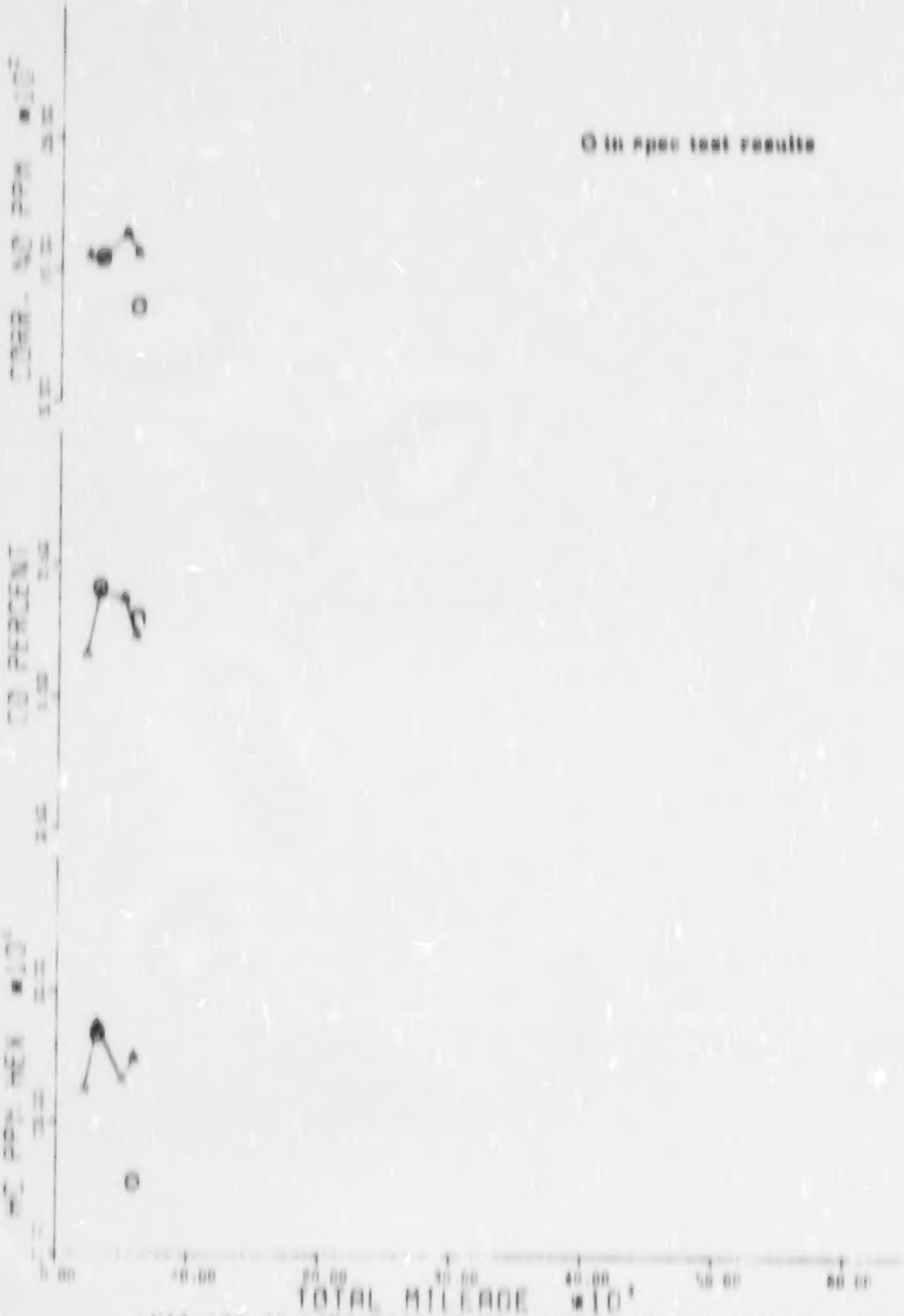


UNIT 104 70 CHEV 7500 LB GVW MAINT. TR 307 CID V8 ENGINE

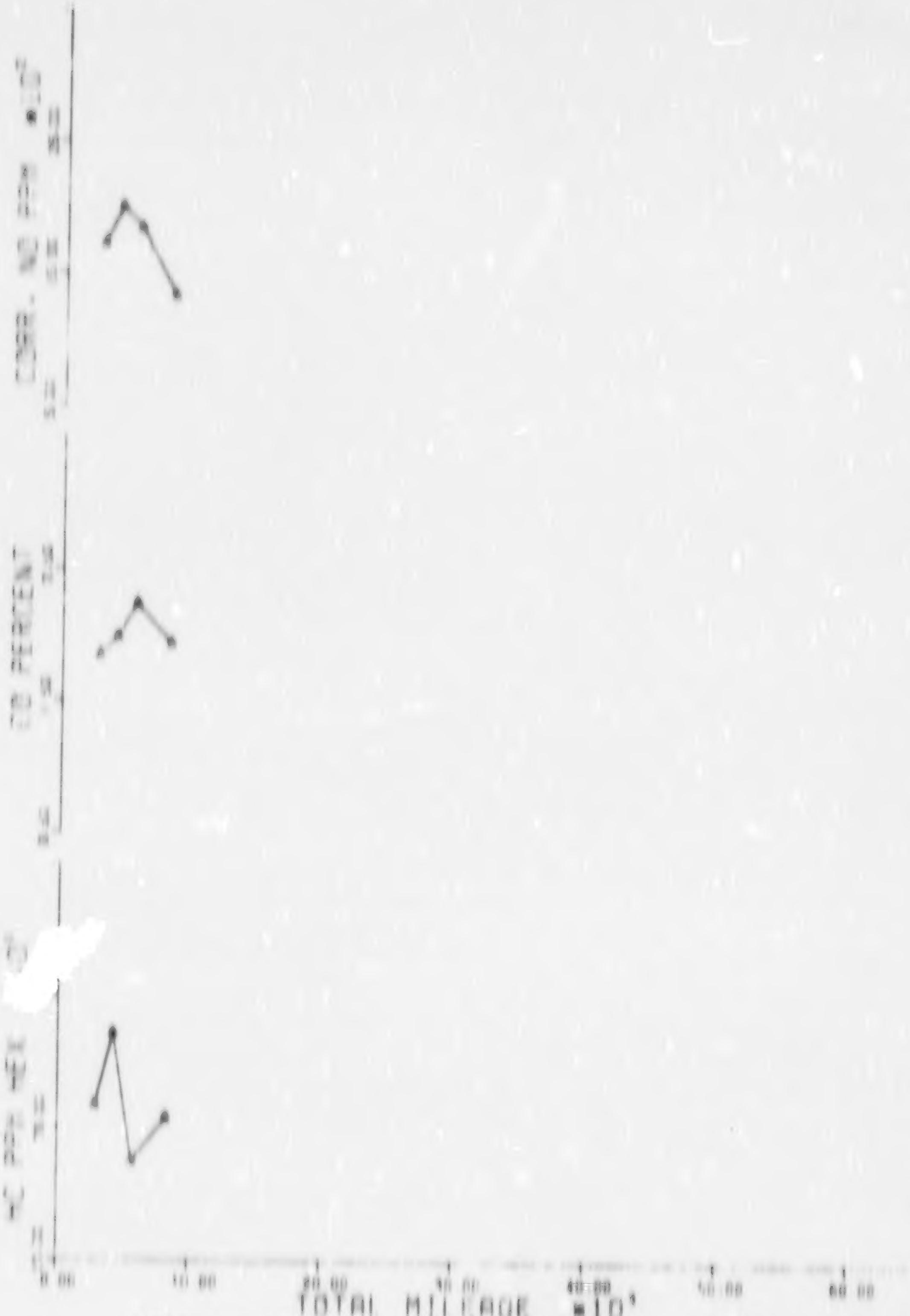
E-105



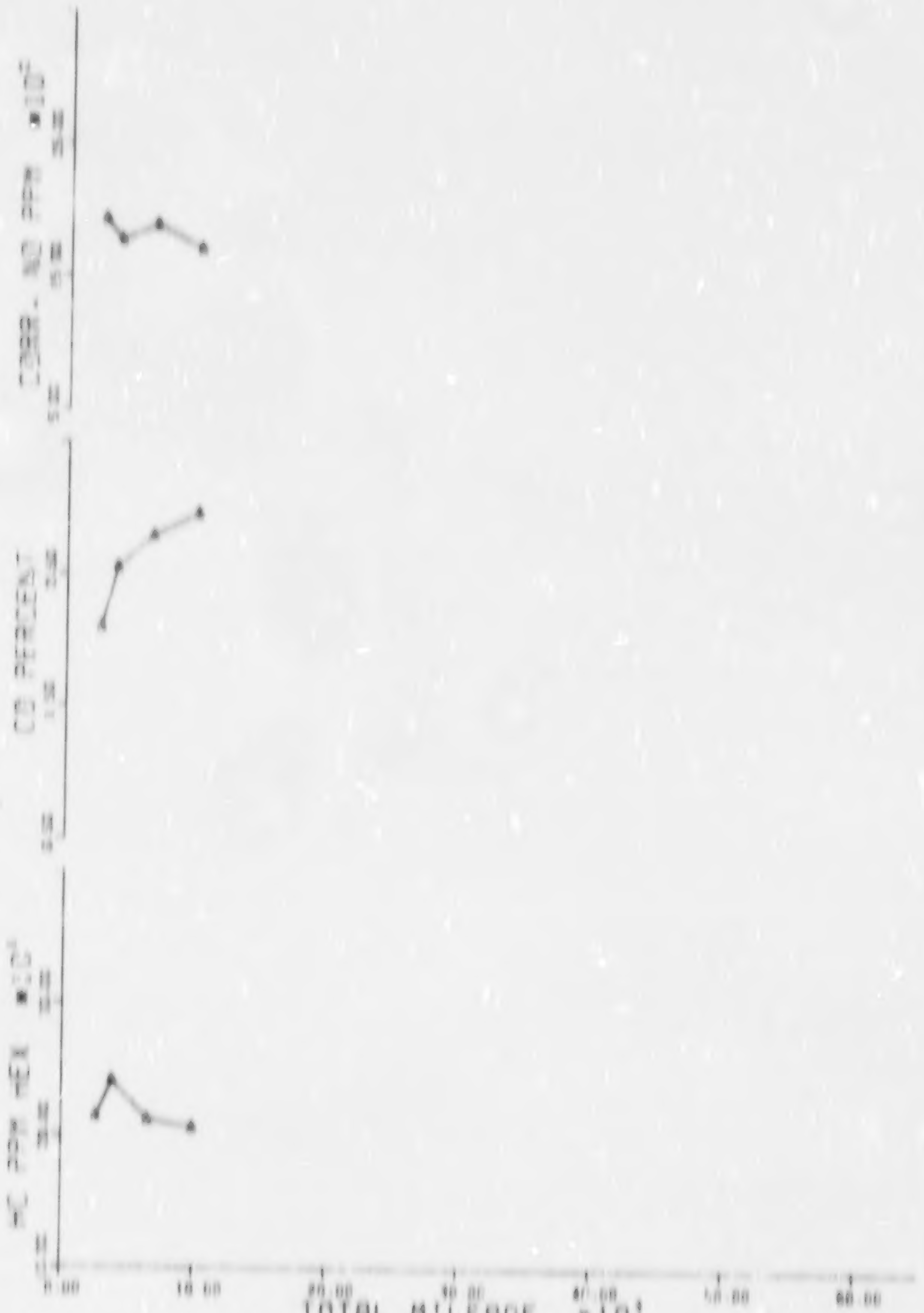
UNIT 106 70 THE 25500 LB GVW MAINT. TR 392 CID V8 ENGINE



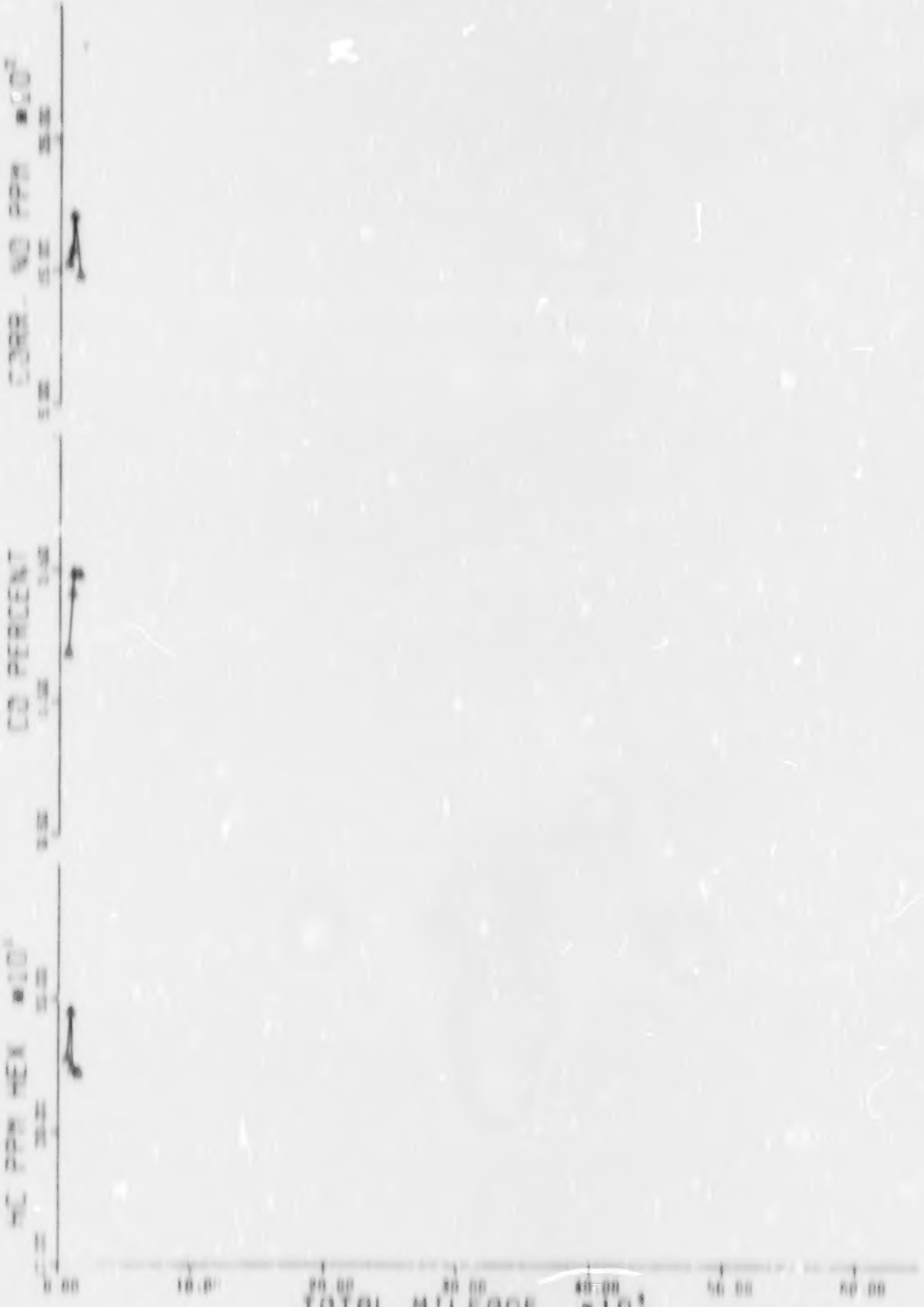
UNIT 108 70 FORD 8500 LB GVW MAINT. TR 360 CID V8 ENGINE



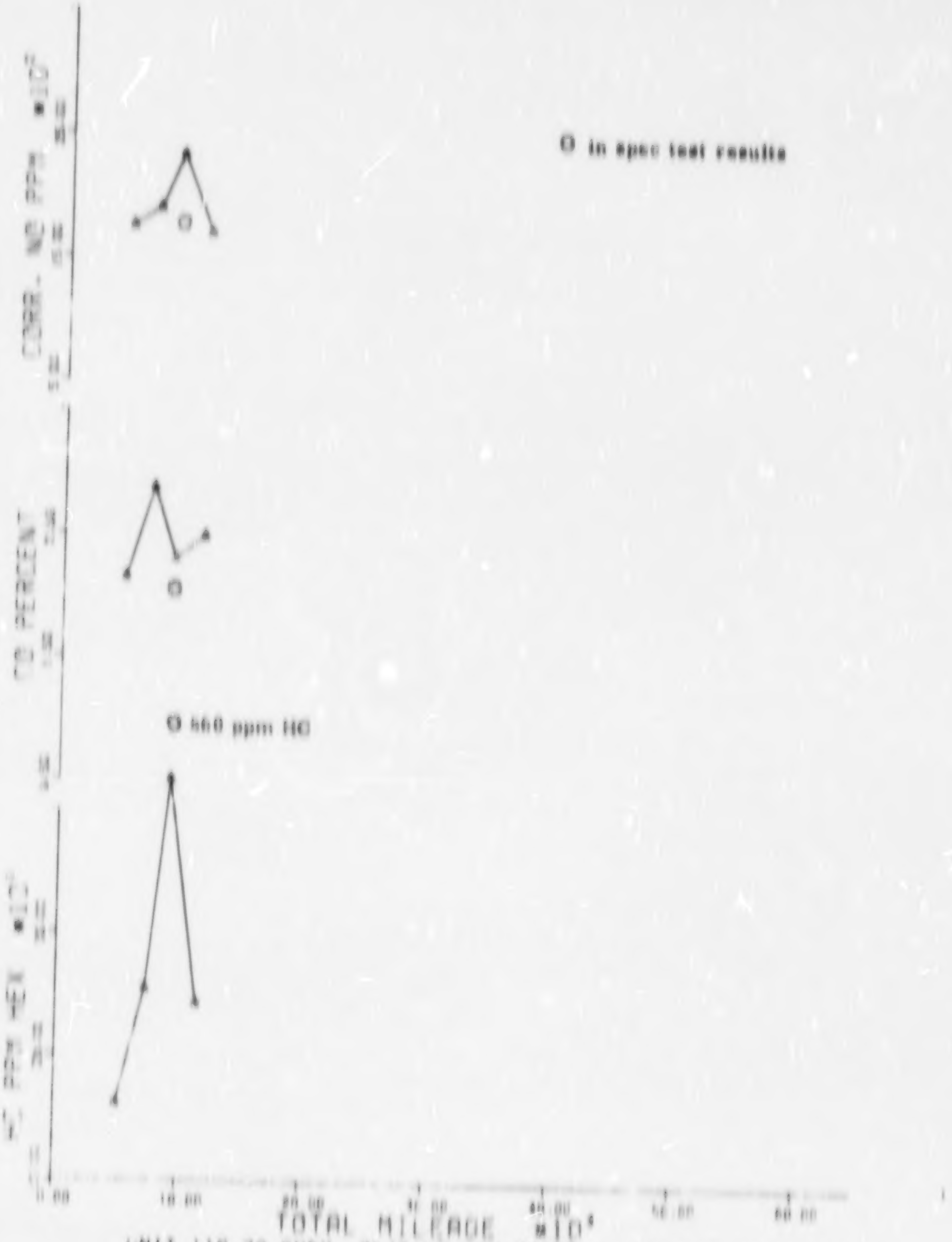
UNIT 107 70 CHEV 7500 LB GVW MAINT. 307 CID V8 ENGINE



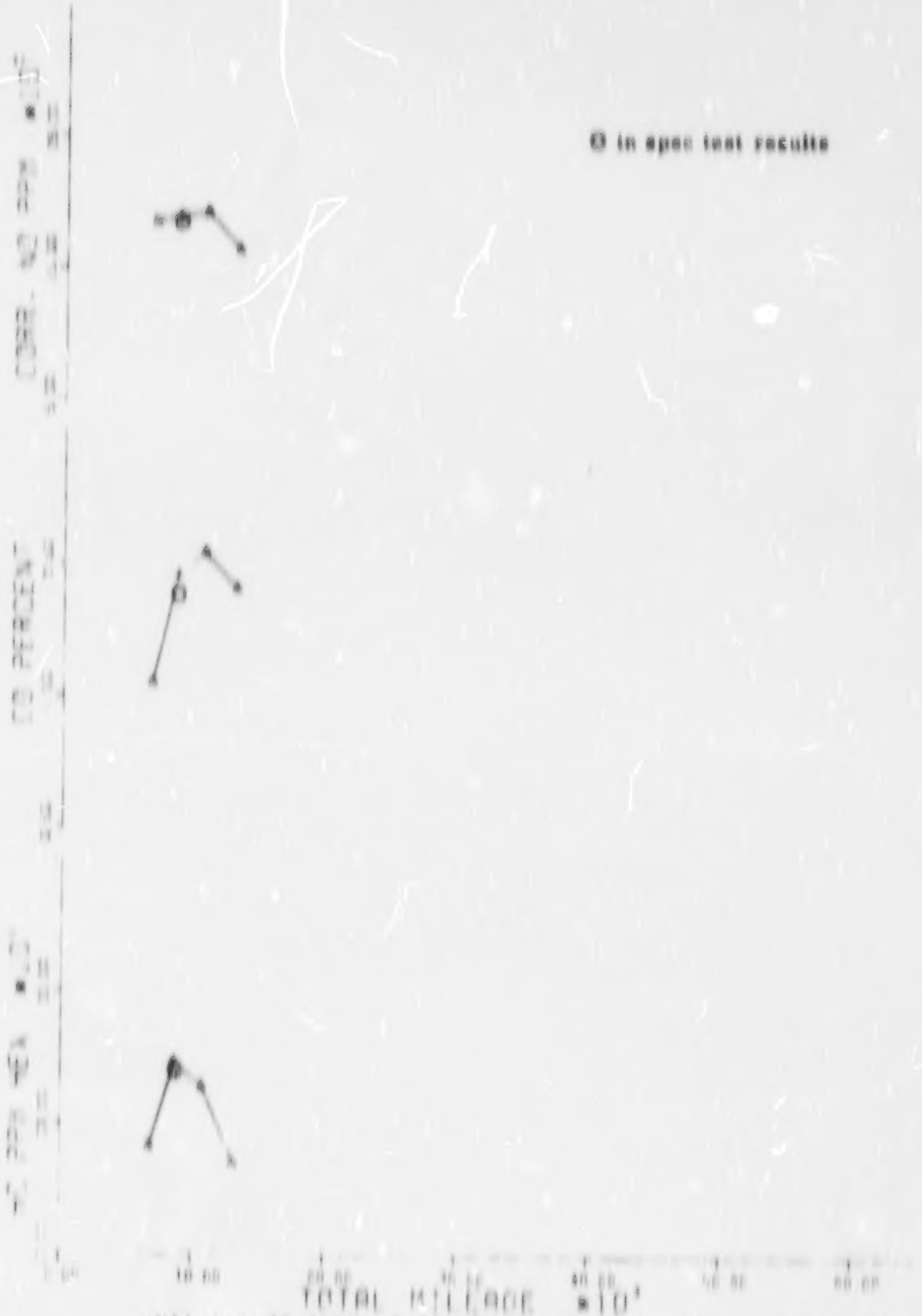
UNIT 108 70 CHEV 10000 LB GVW MAINT.   307 CID V8 ENGINE



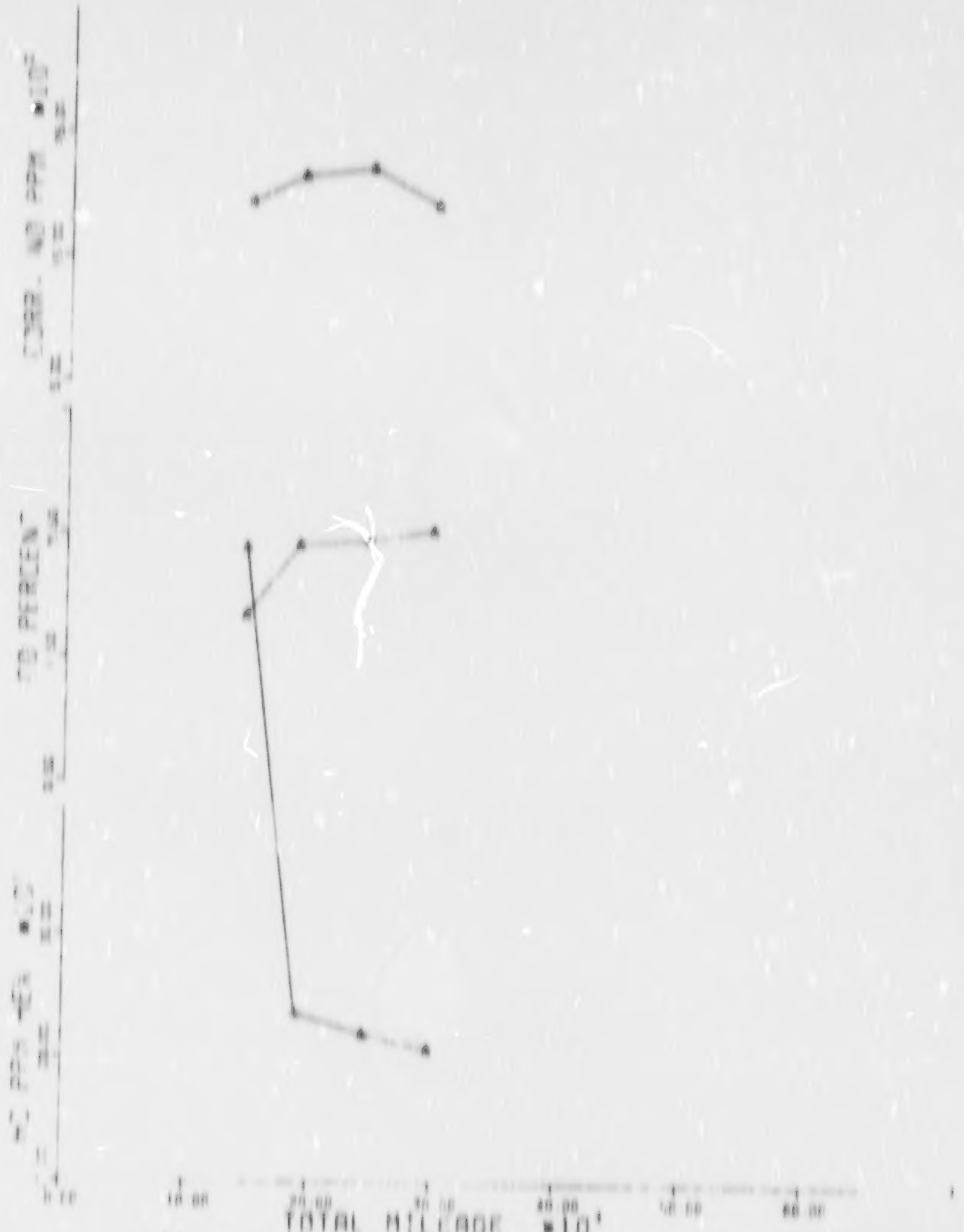
UNIT 139 70 CHEV 10000 LB GVW MAINT. 307 CID V8 ENGINE



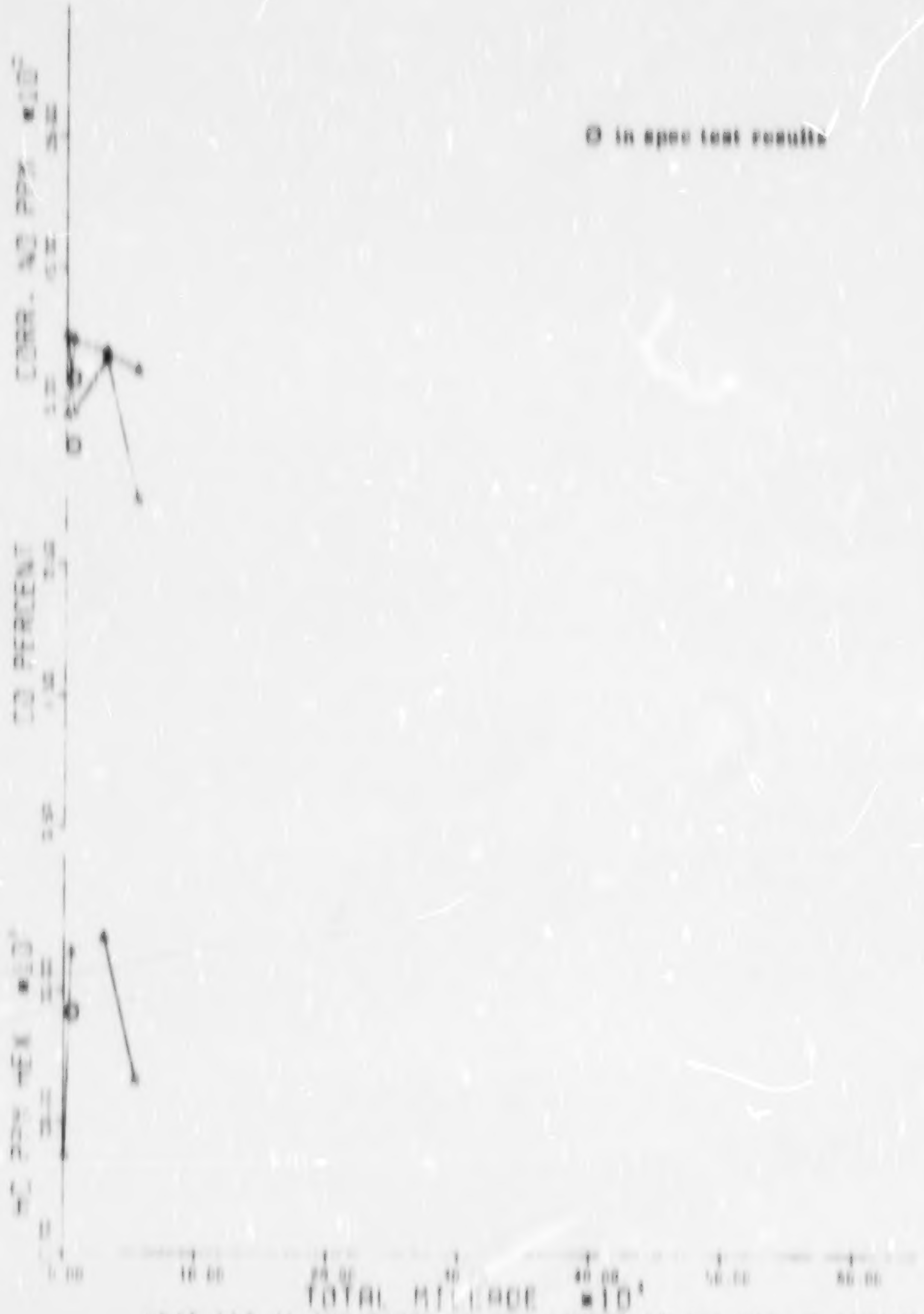
UNIT 110 70 CHEV 7500 LB GVW MAINT. 307 CID V8 ENGINE



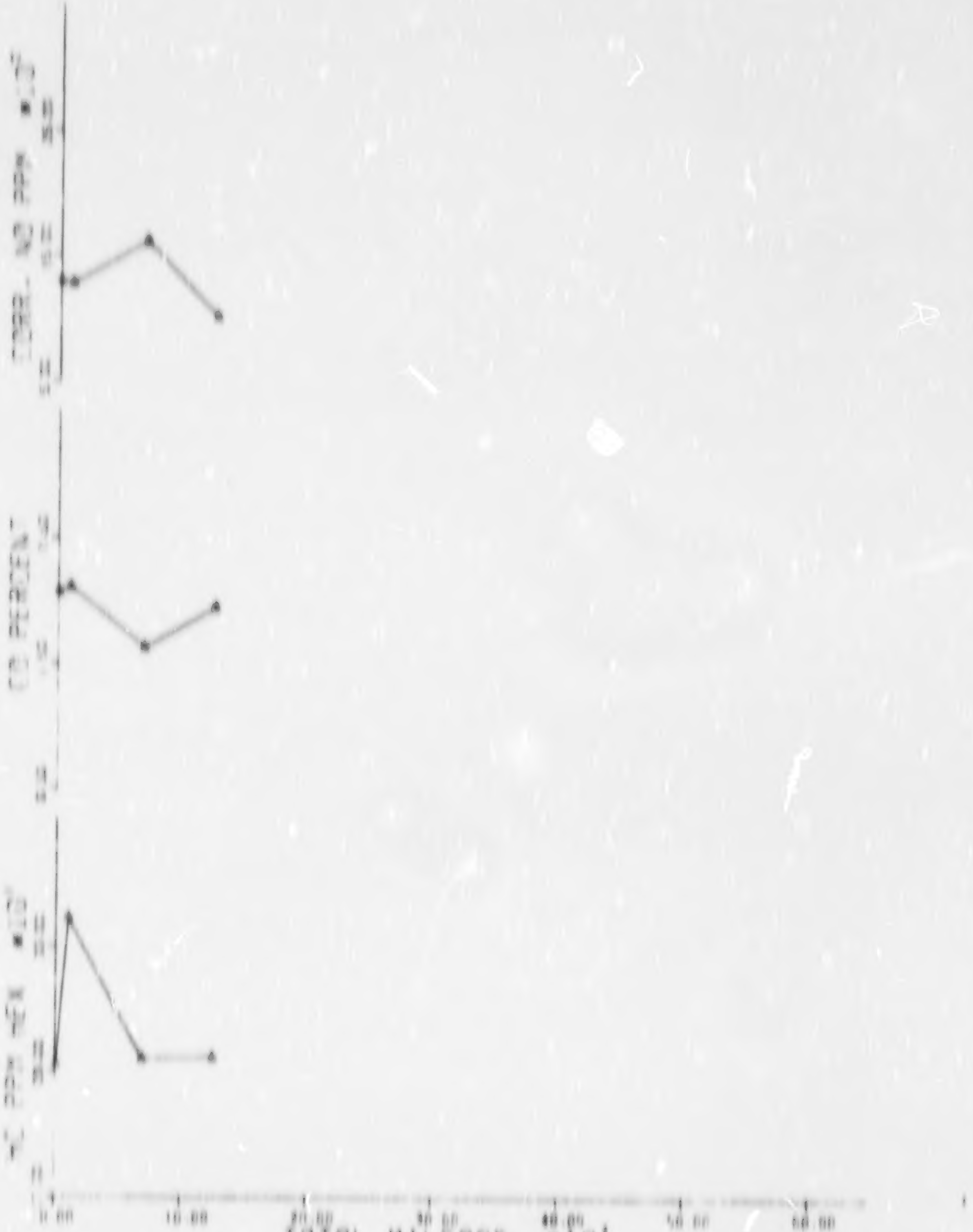
UNIT 111 70 CHEV 7500 LB GVW MAINT. 307 CID V8 ENGINE



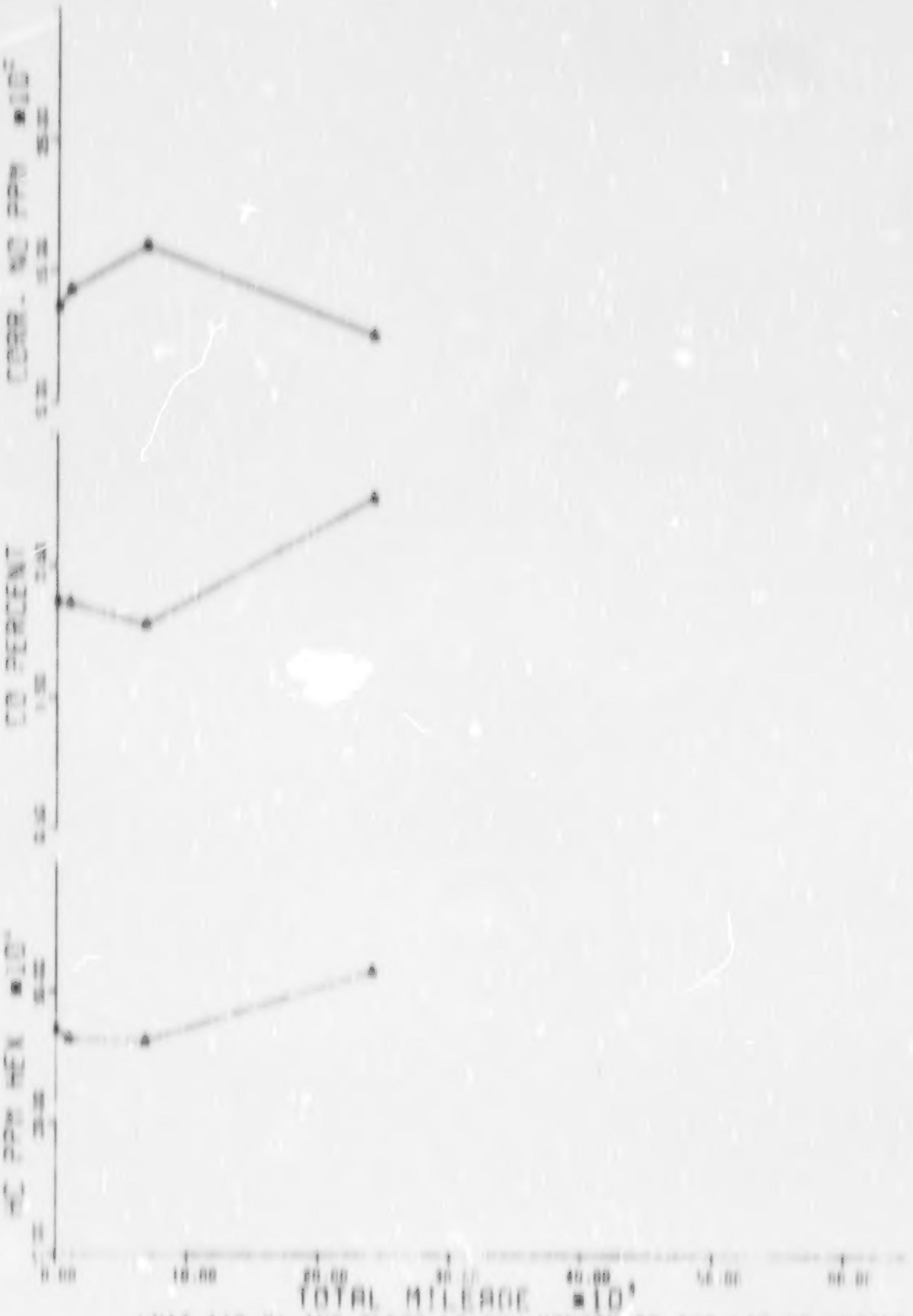
UNIT 112 70 CHEV 10000 LB OVH MAINT. 307 CID V8 ENGINE



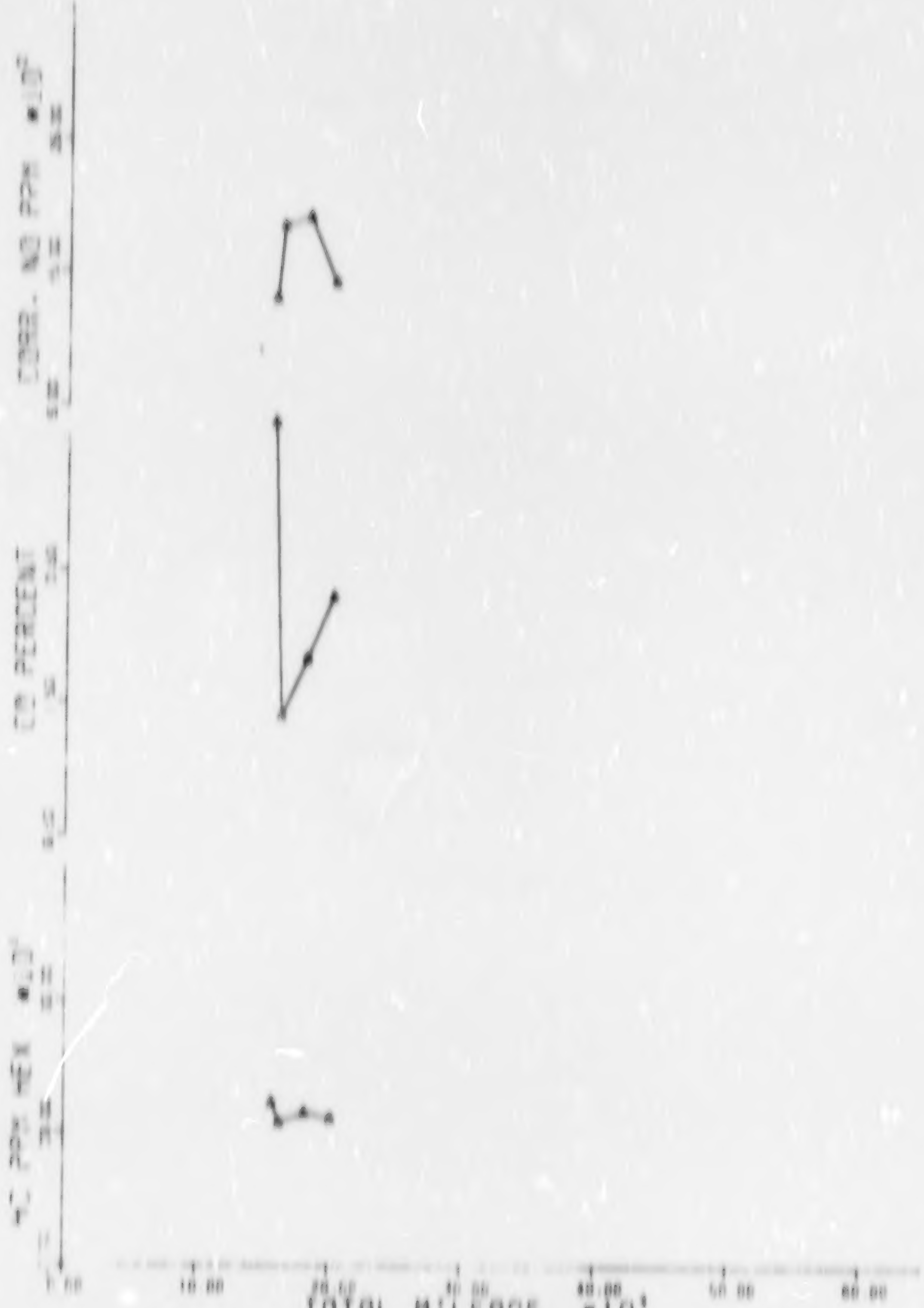
UNIT 113 71 IHC 24000 LB GVW CONSTR.TR 392 CID V8 ENGINE



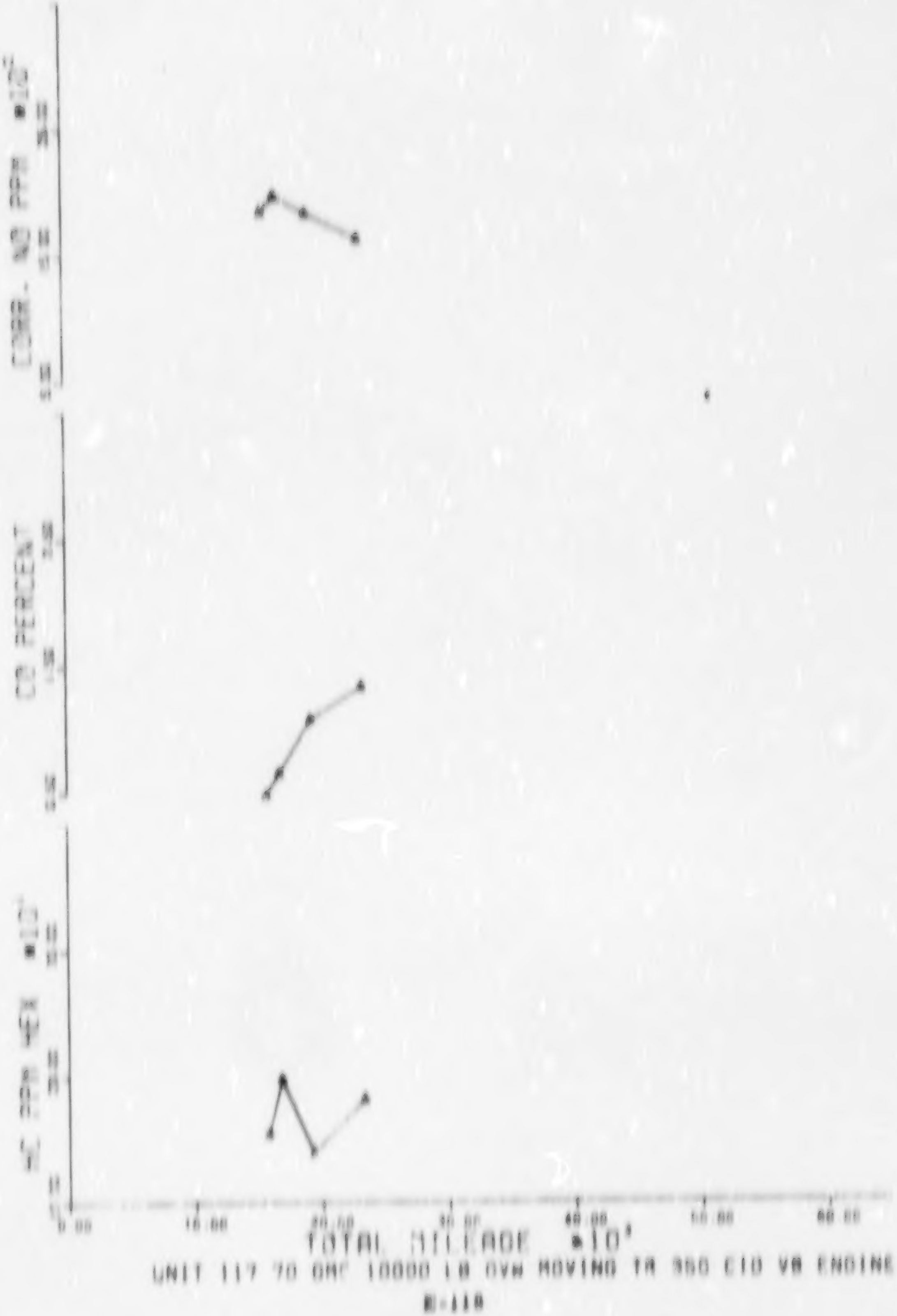
UNIT 114 71 IHC 25500 LB GVW CONSTR TR 392 CID V8 ENGINE



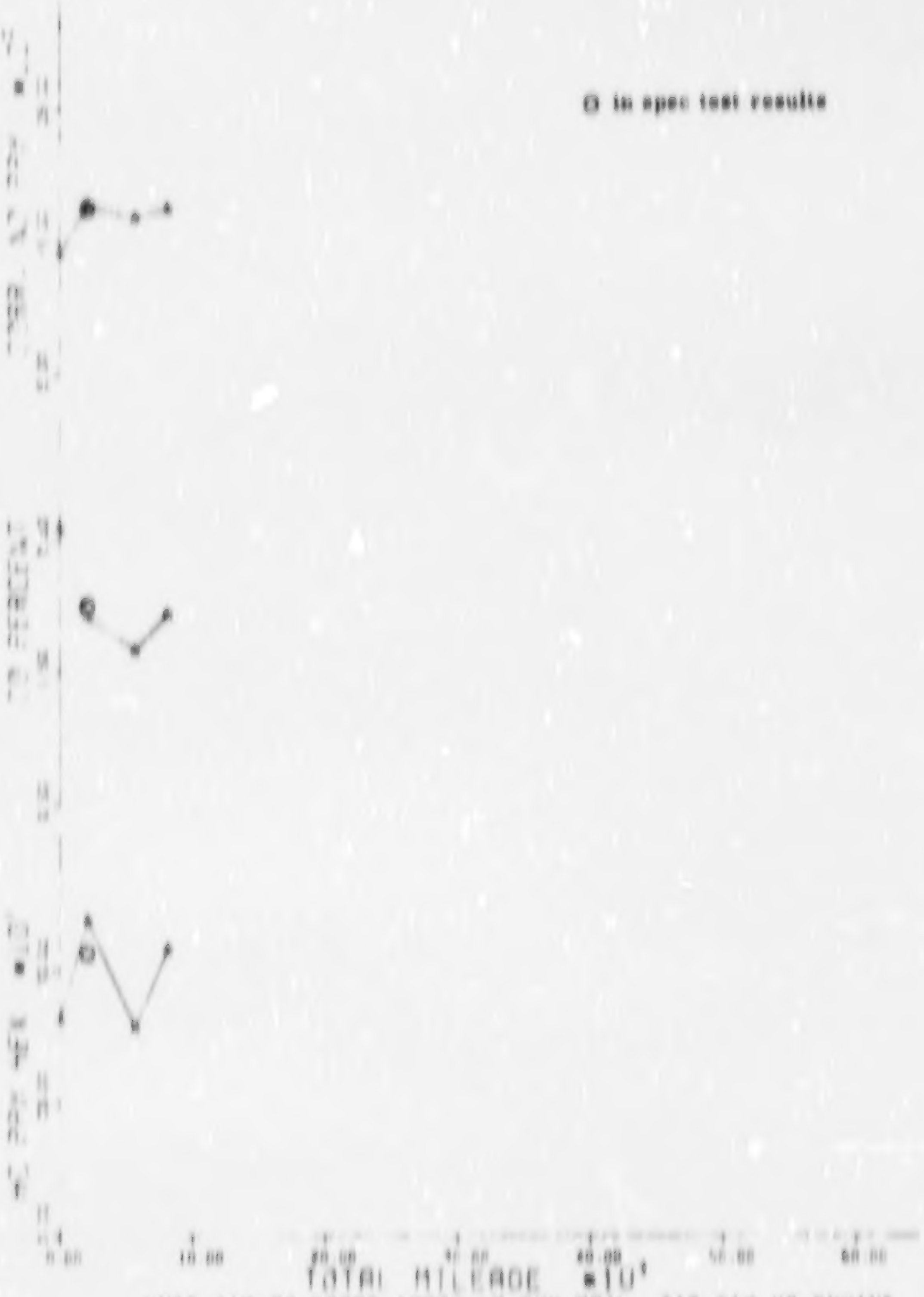
UNIT 115 71 IHC 25500 LB SVW CONSTR.TR 392 CID V8 ENGINE



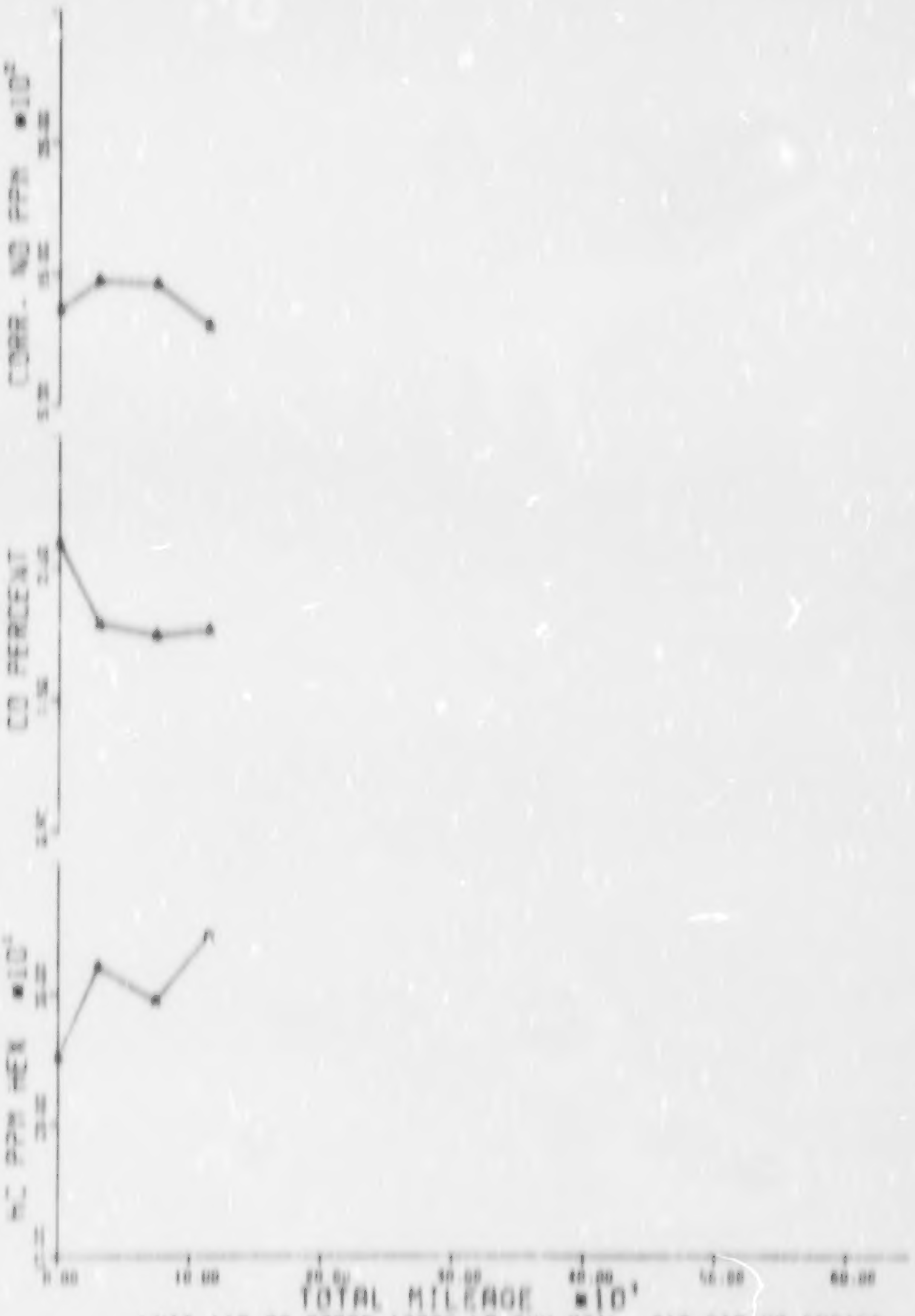
UNIT 118 70 GMC 14000 LB GVW MOVING TR 350 CID V8 ENGINE



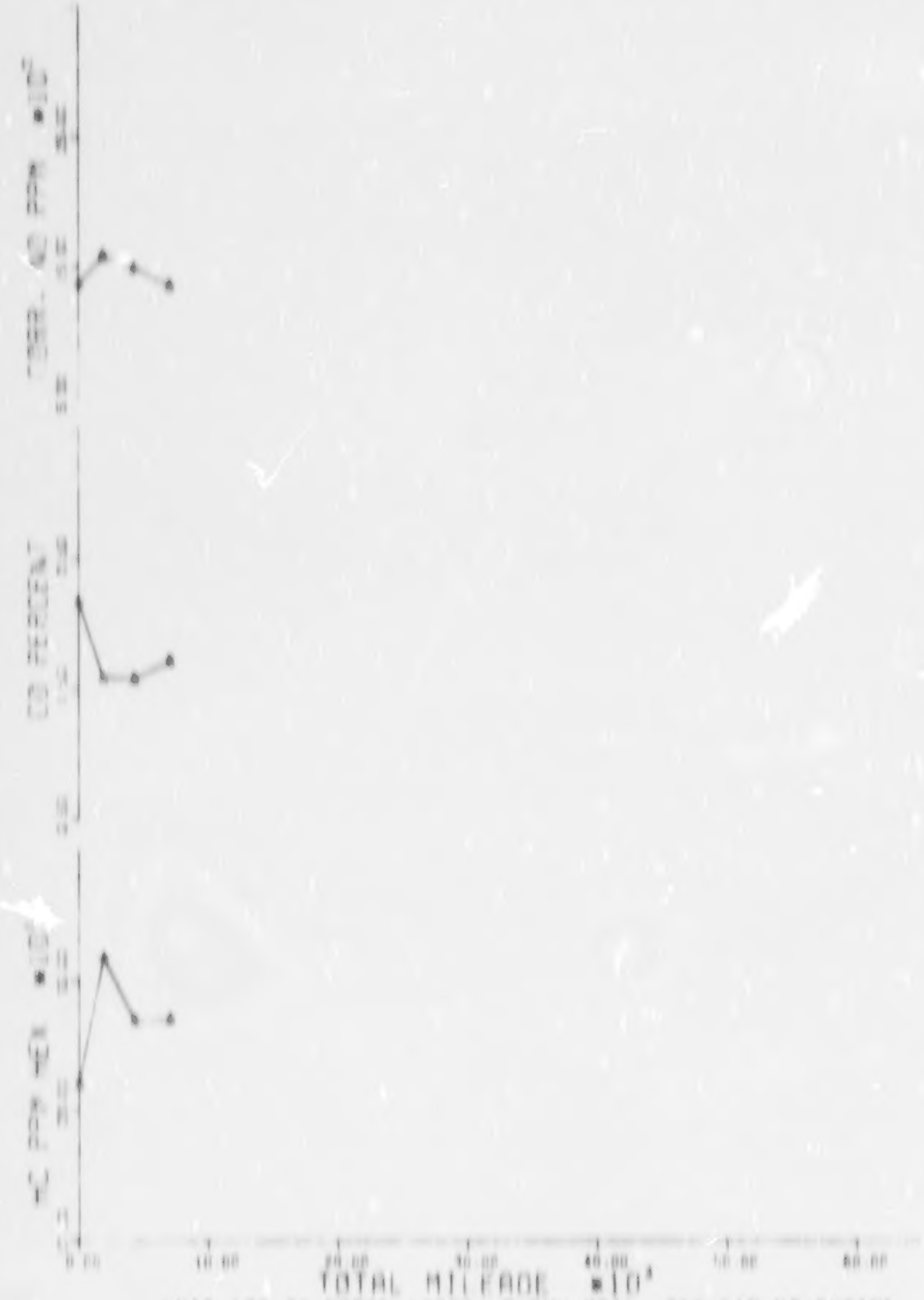
UNIT 117 70 GMC 10000 LB GVW MOVING TR 350 CID V8 ENGINE



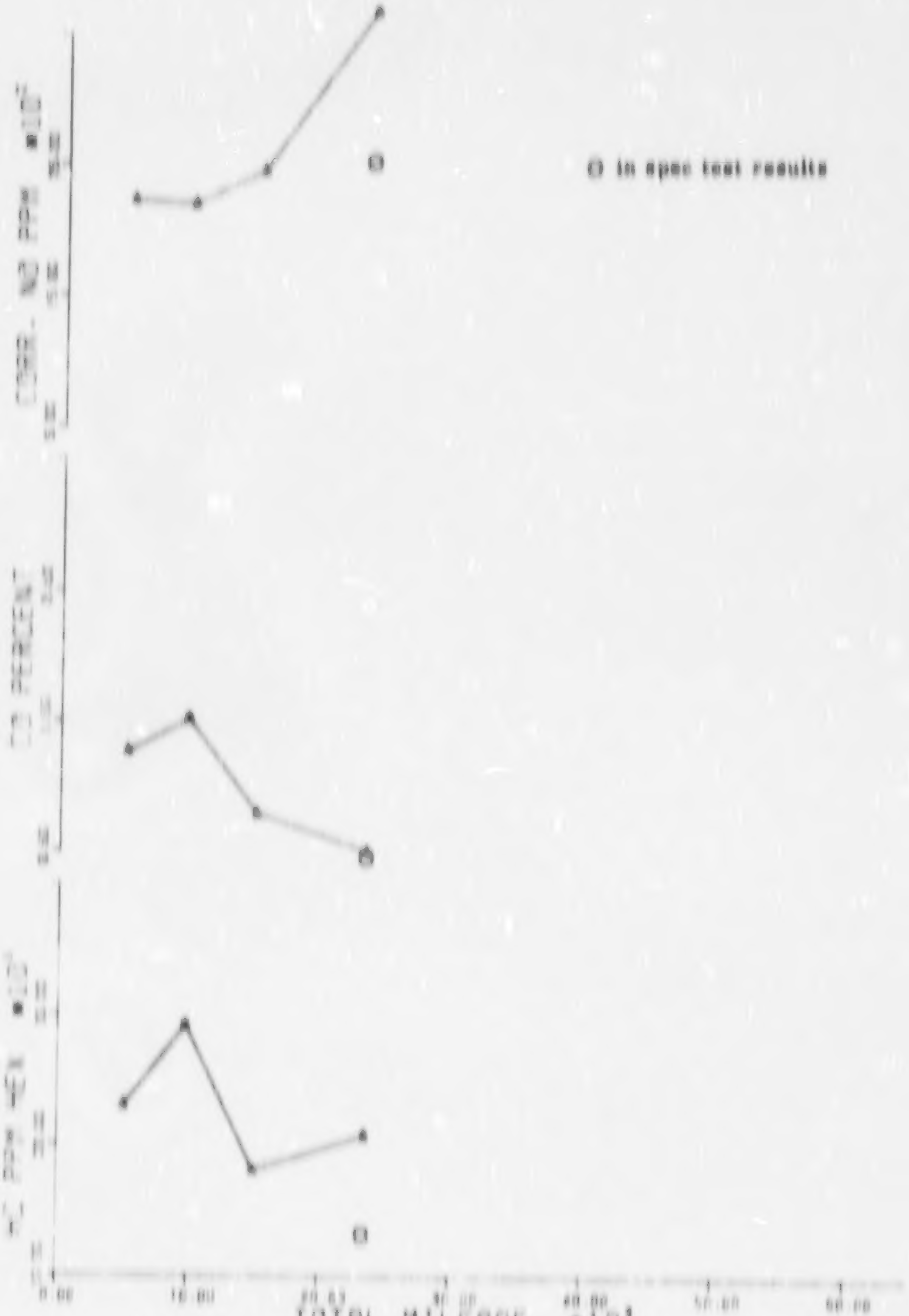
UNIT 118 70 DODGE 10000 LB GVW MAIL 318 CID V8 ENGINE



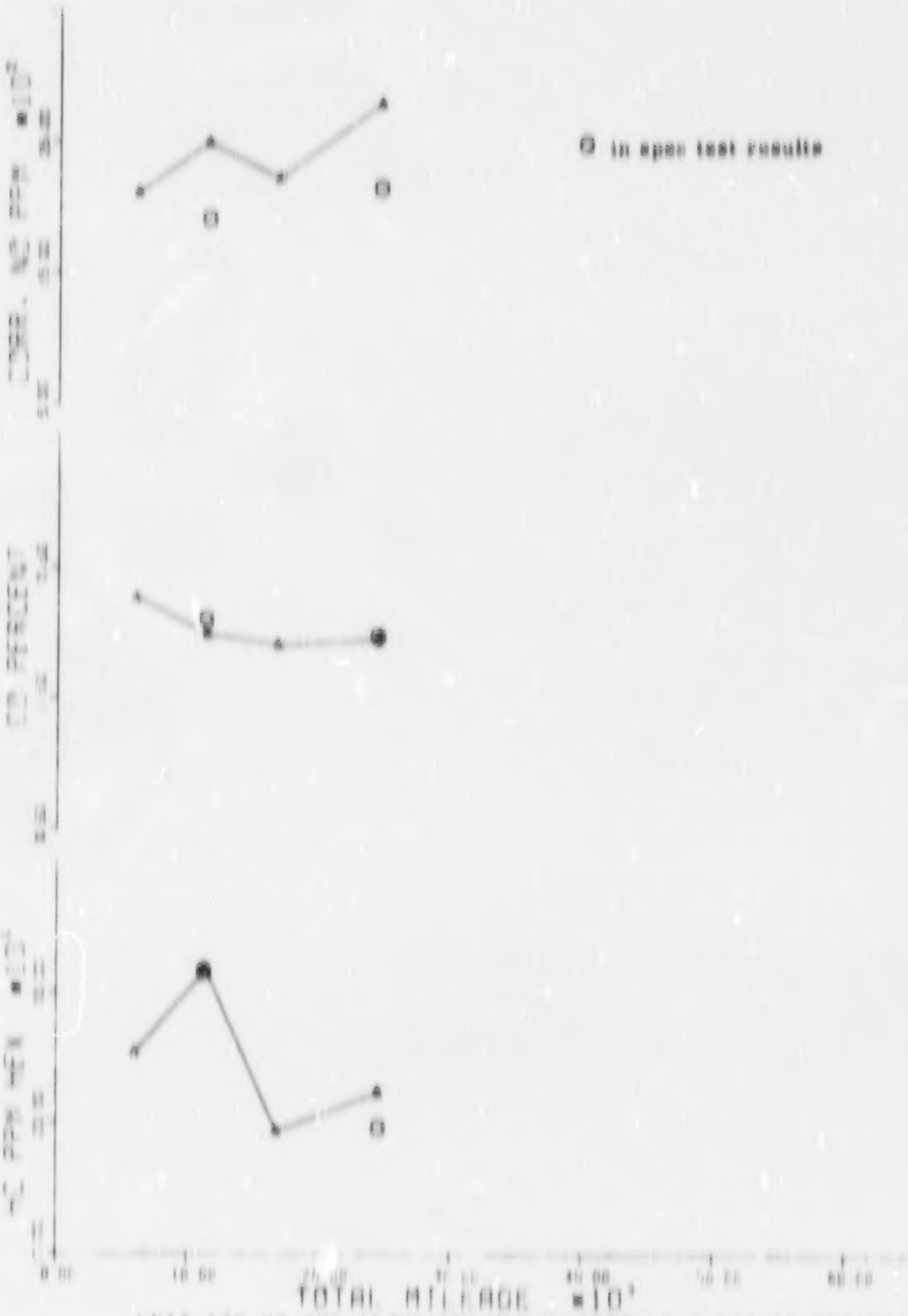
UNIT 119 70 DODGE 10000 LB GVW MAIL 318 CID V8 ENGINE



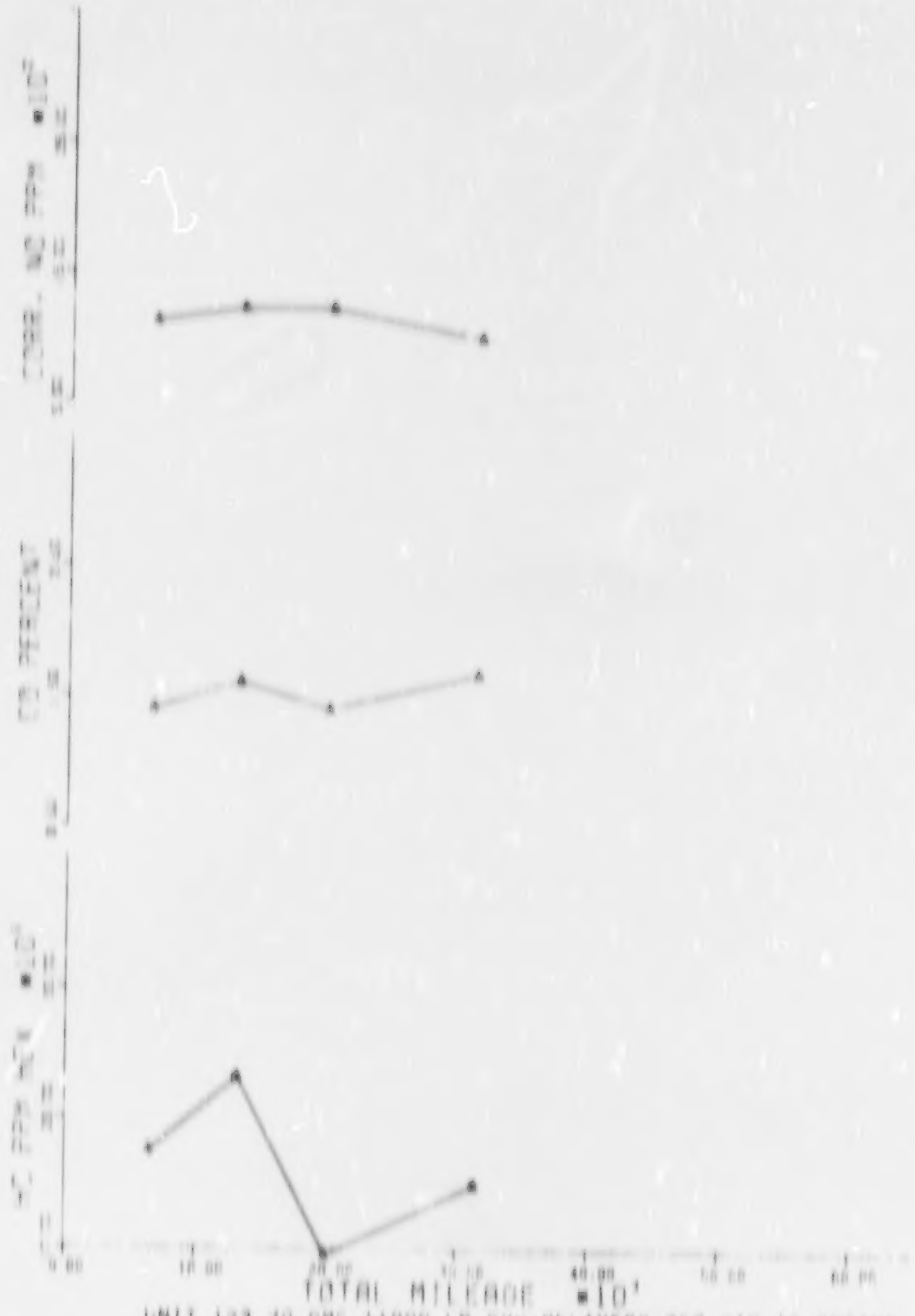
UNIT 128 76 DODGE 10000 LB GVW MAIL 318 CID V8 ENGINE



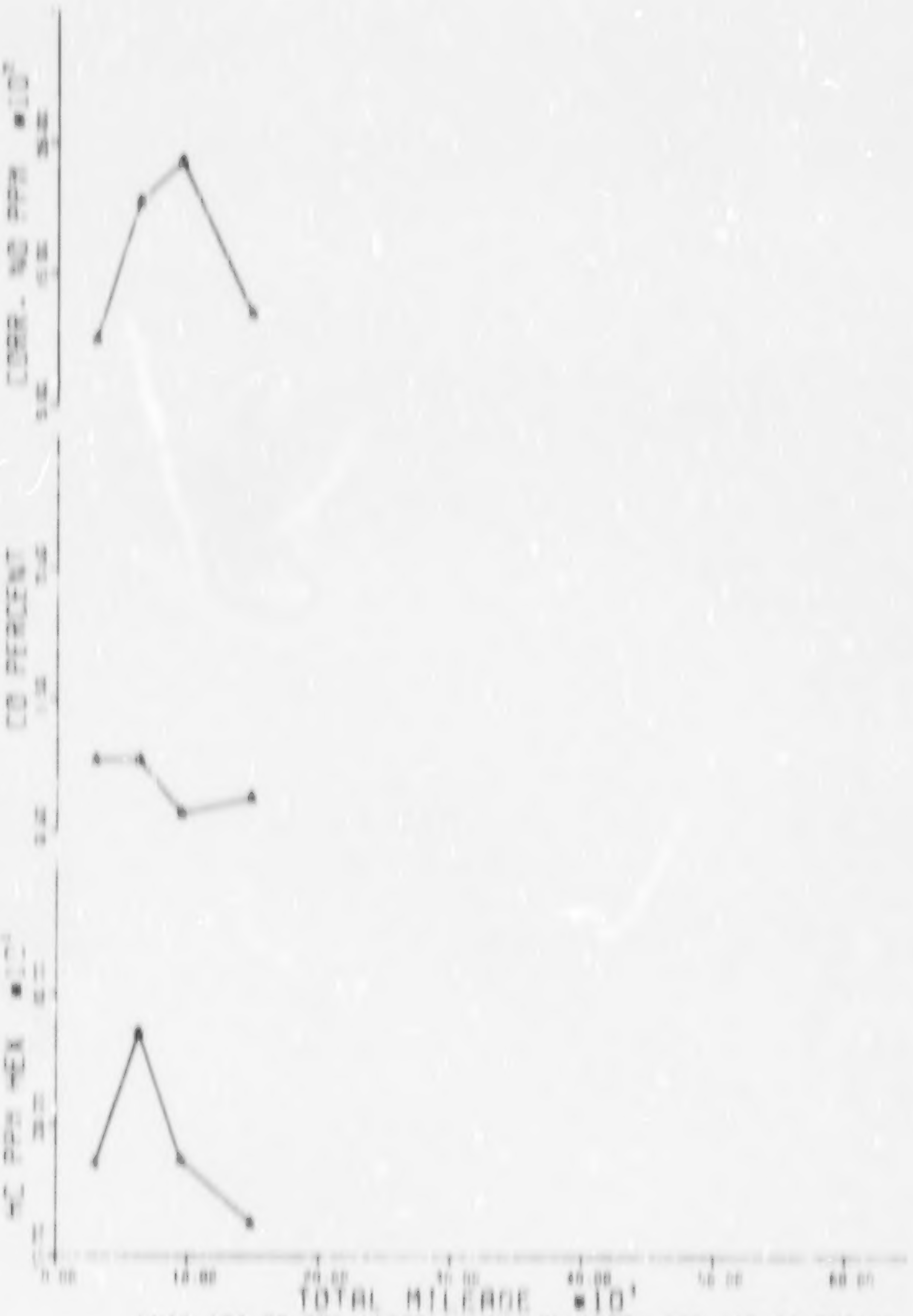
UNIT 121 TO GMC 10000 LB GVW DELIVERY 292 CID I6 ENGINE



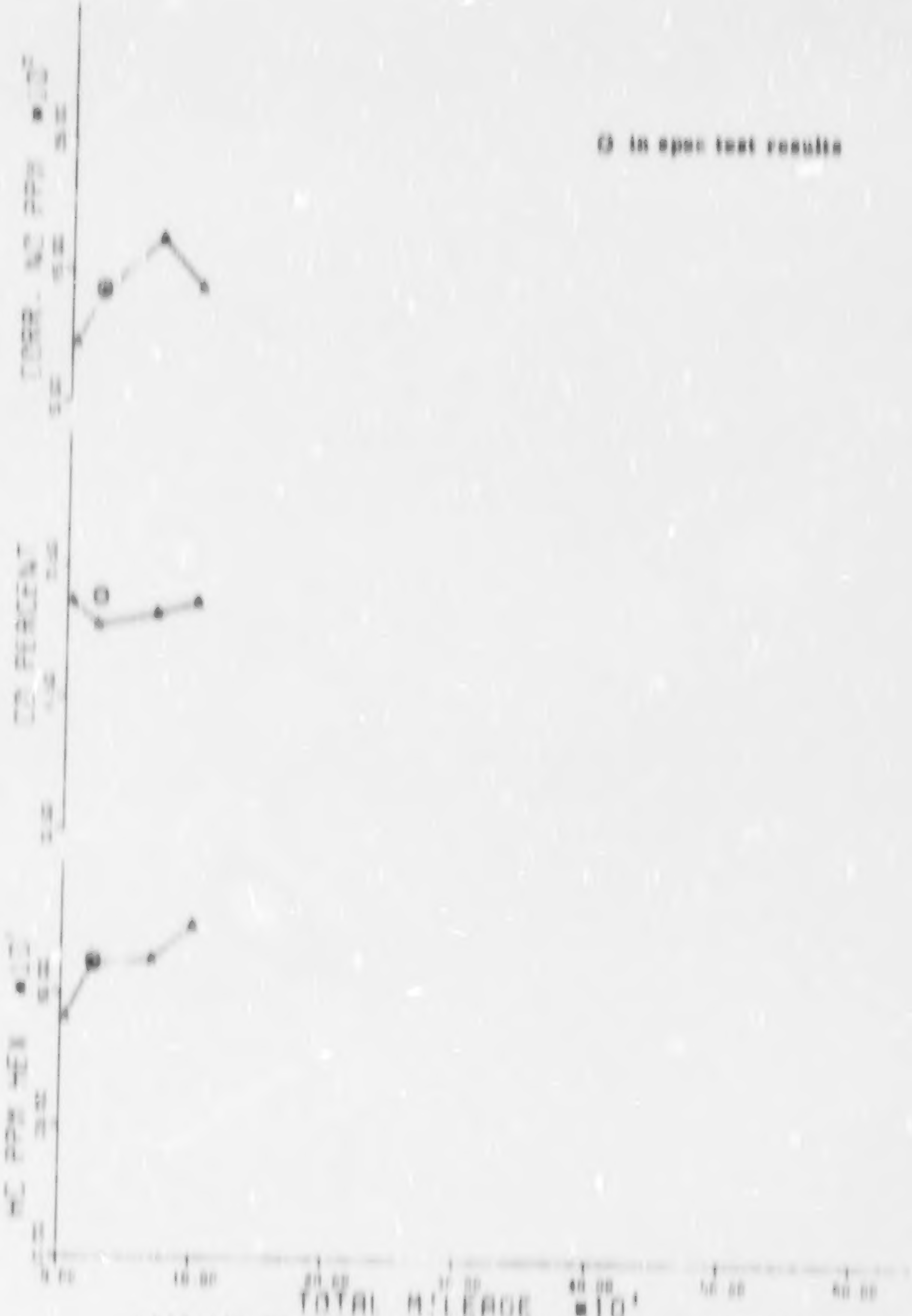
UNIT 172 78 GMC 10,700 LB GVW DELIVERY 292 CID I6 ENGINE



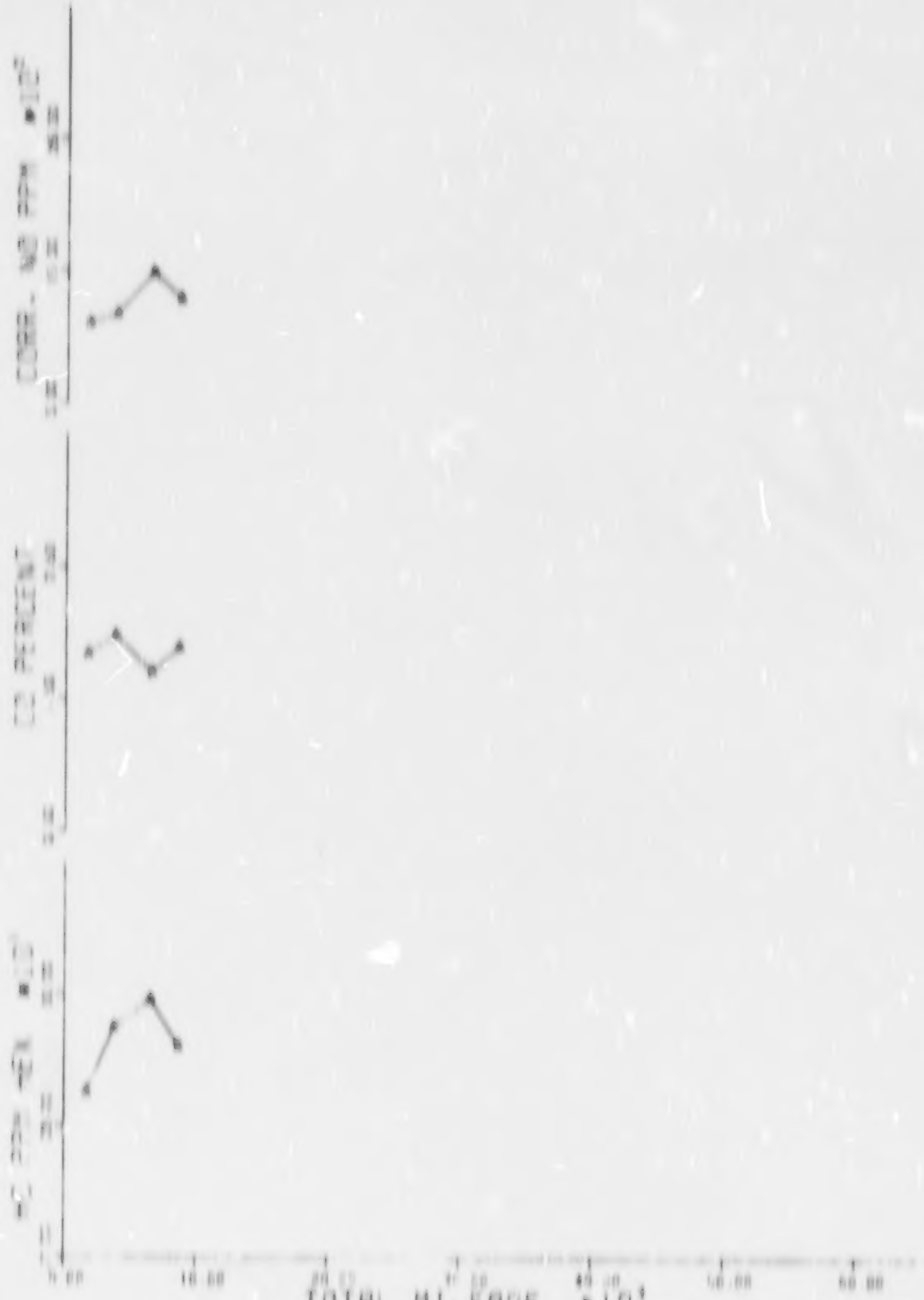
UNIT 123 70 GMC 11000 LB GVW DELIVERY 292 CID I6 ENGINE



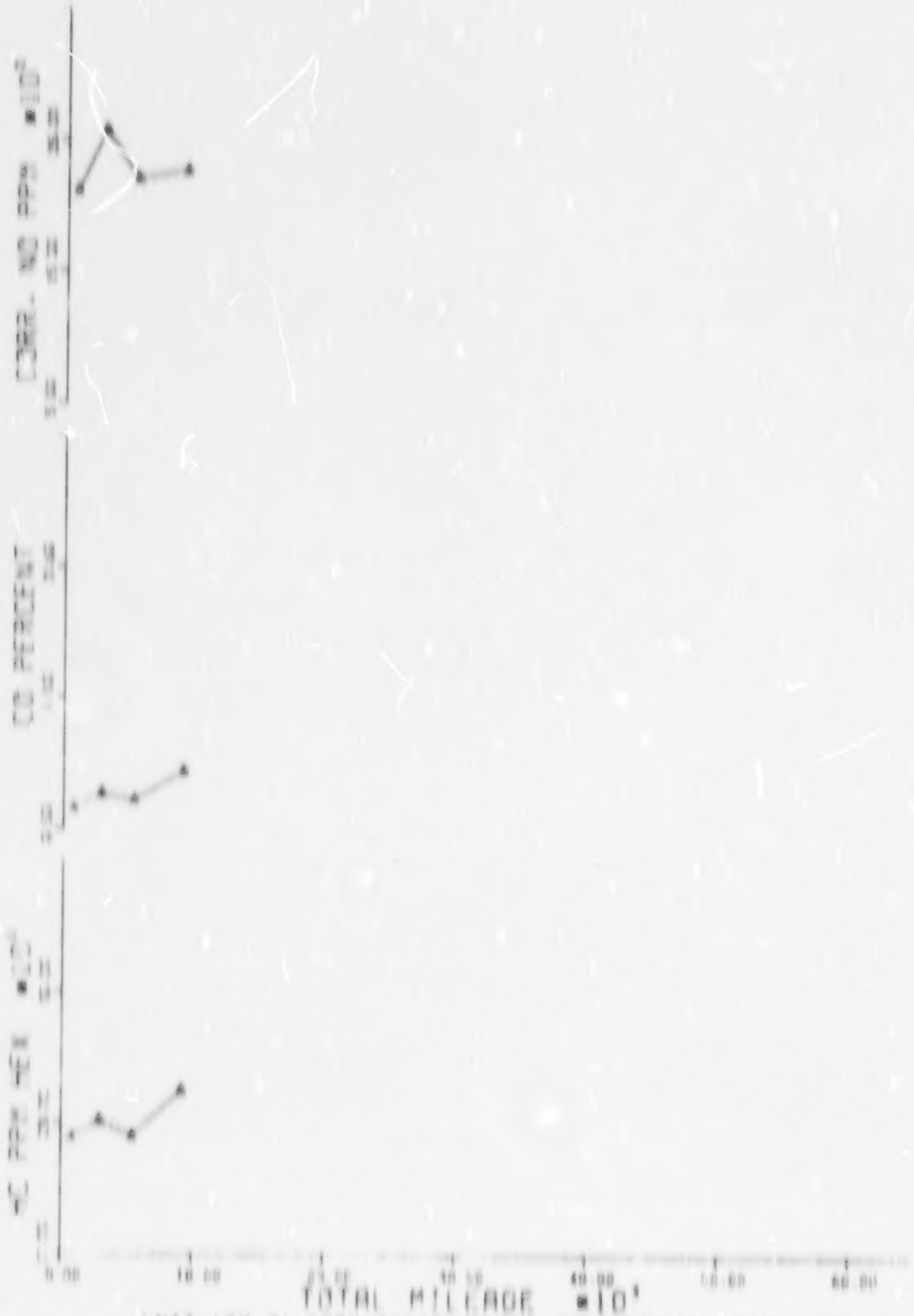
UNIT 174 70 GMC 11000 LB GVW DELIVERY 292 CID I6 ENGINE



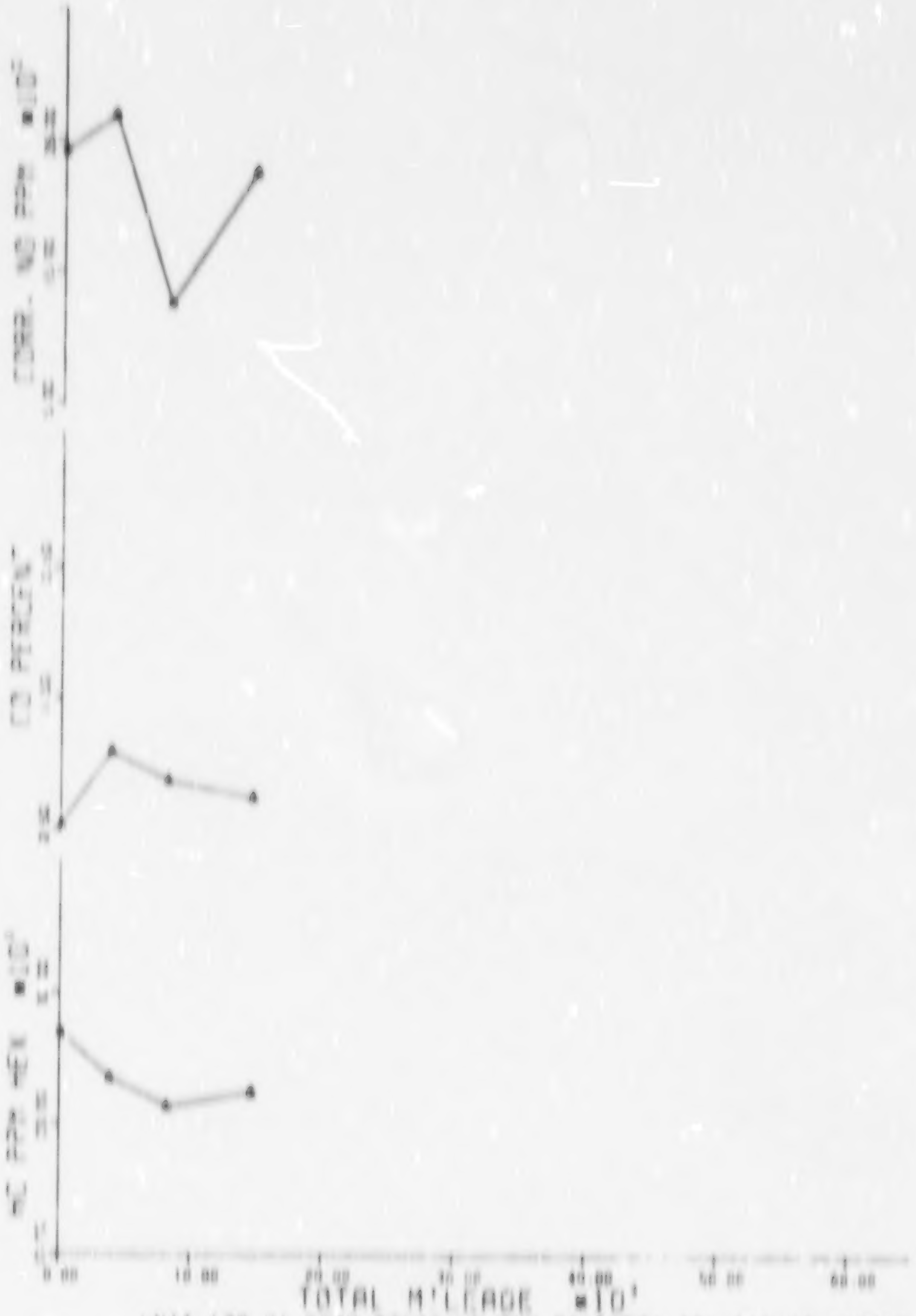
UNIT 125 70 DODGE 7000 LB DVW MAIL TR 318 CID V8 ENGINE



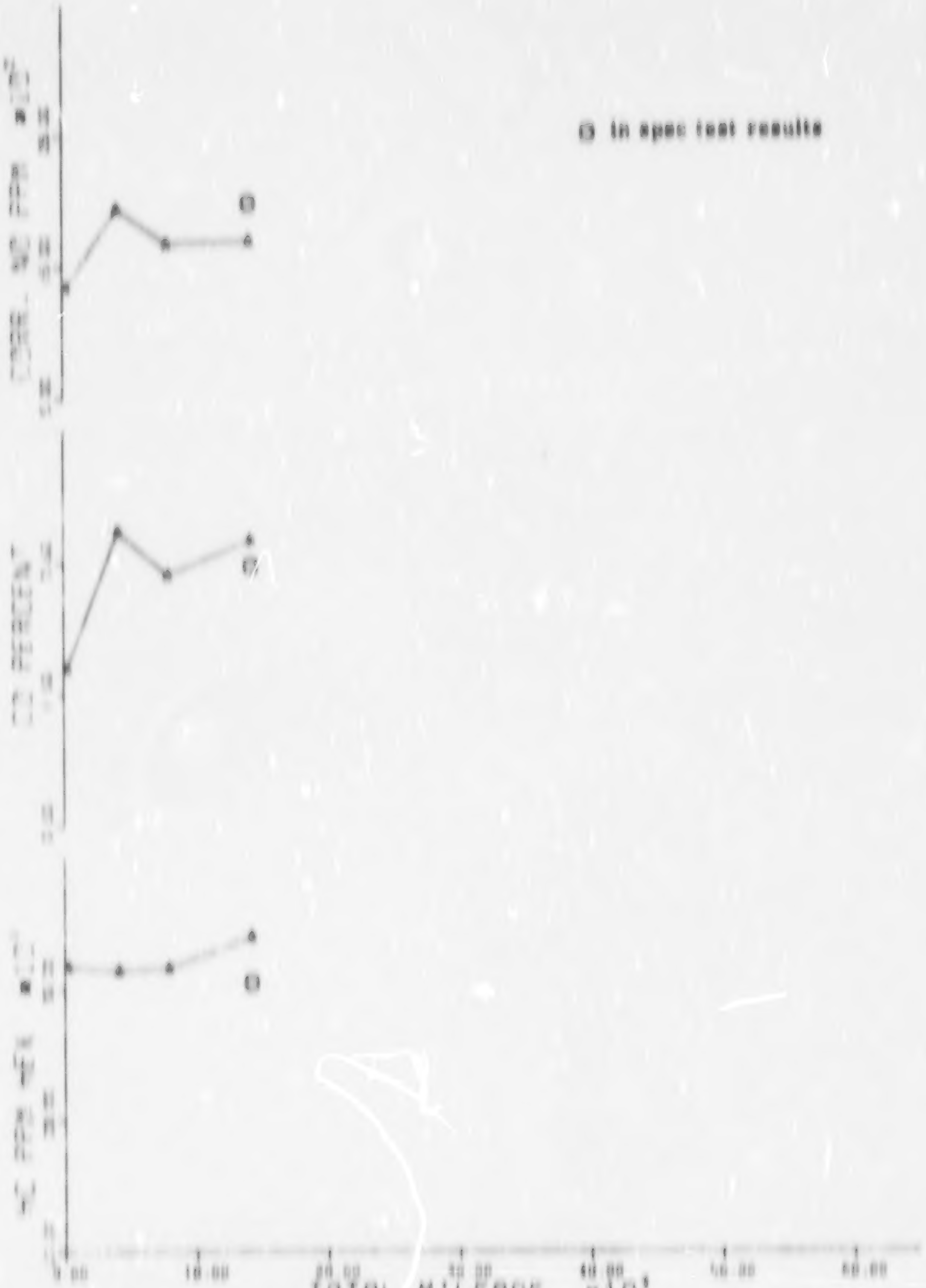
UNIT 126 70 DODGE 7000 LB GVW MAIL TR 318 CID V8 ENGINE



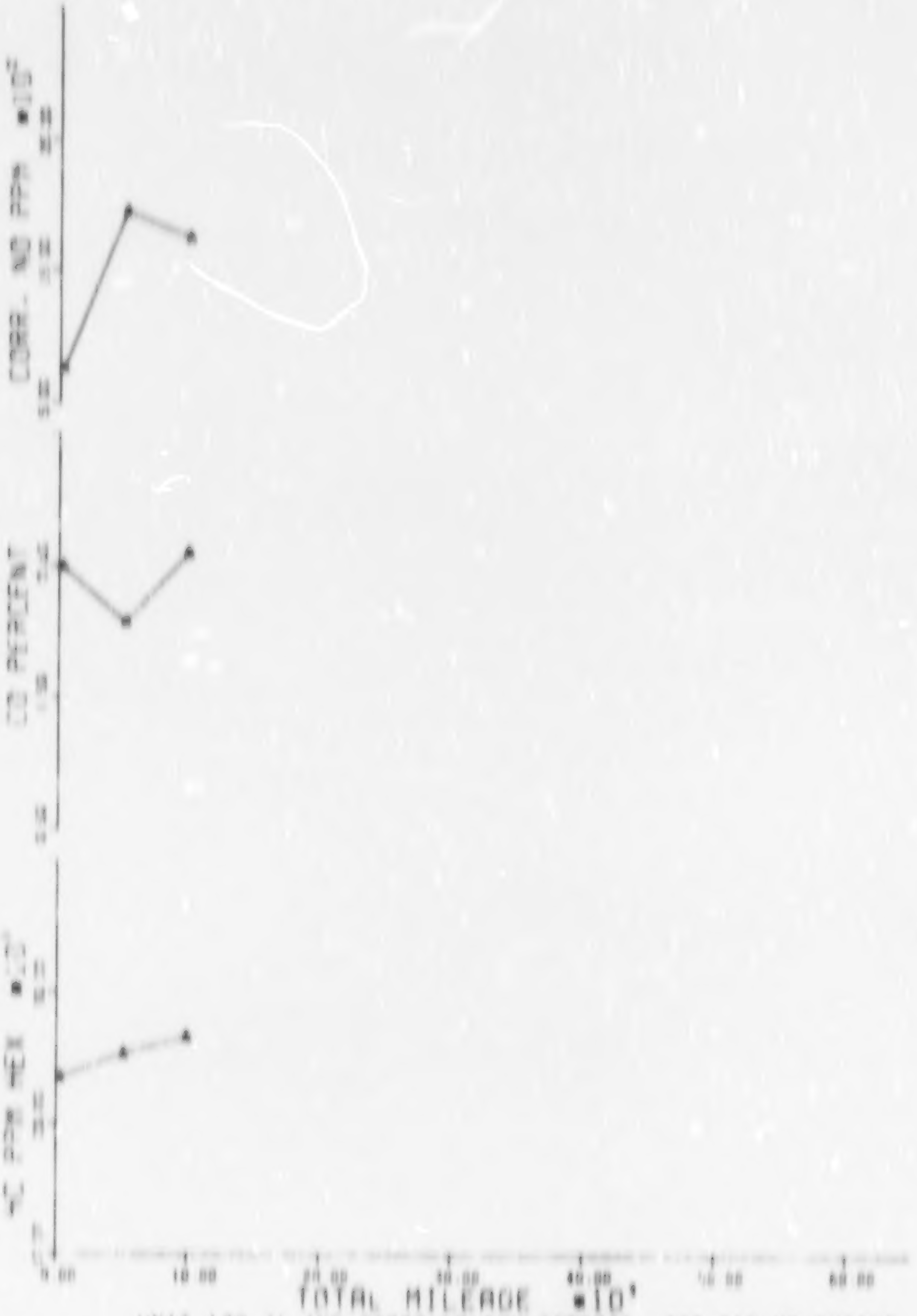
UNIT 127 71 FORD 27500 LB GVW DELIVERY 391 CID V8 ENGINE



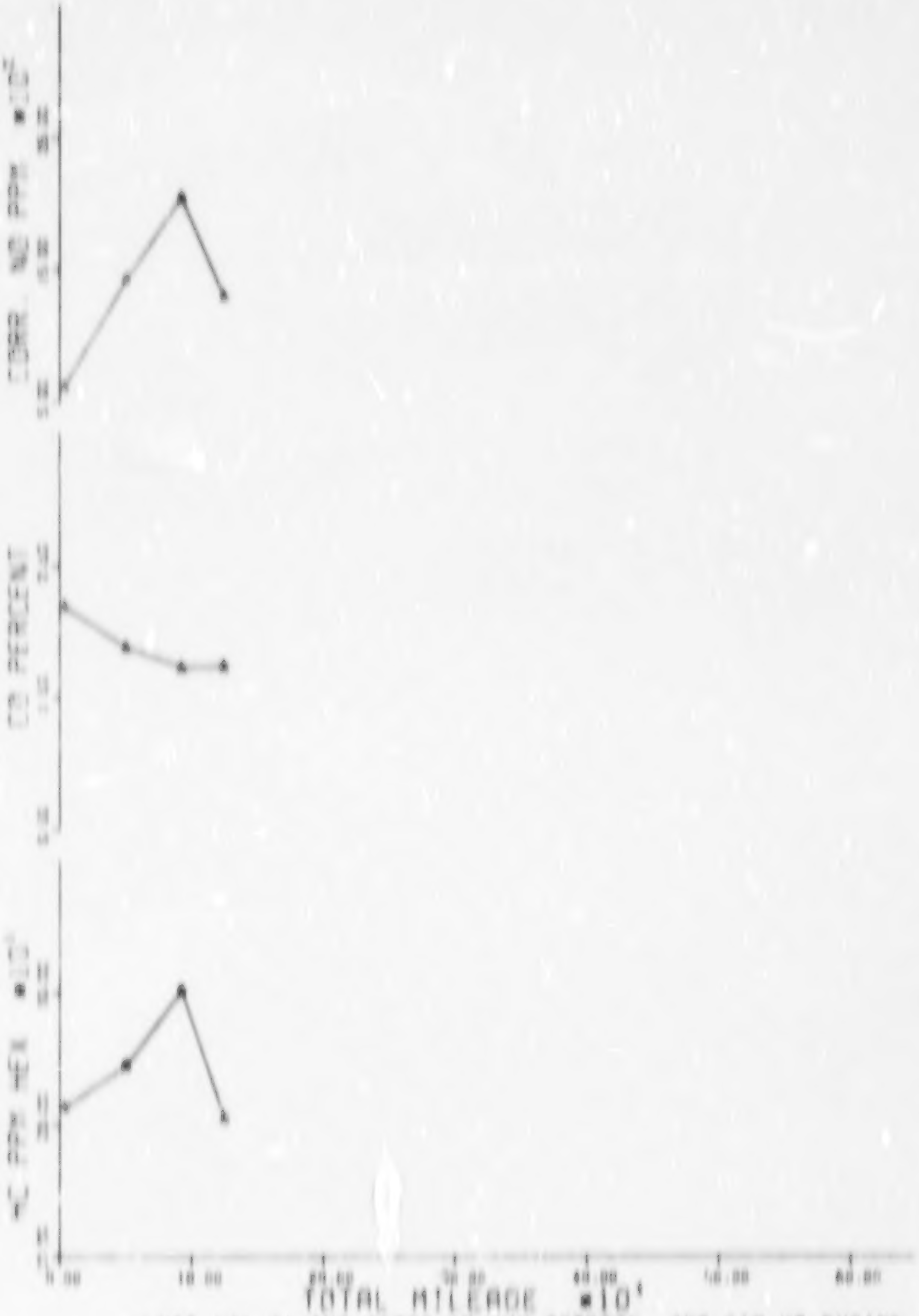
UNIT 12A 71 FORD 27500 LB GVW DELIVERY 391 CID V8 ENGINE



UNIT 129 71 FORD 27500 LB GVW DELIVERY 391 CID V8 ENGINE

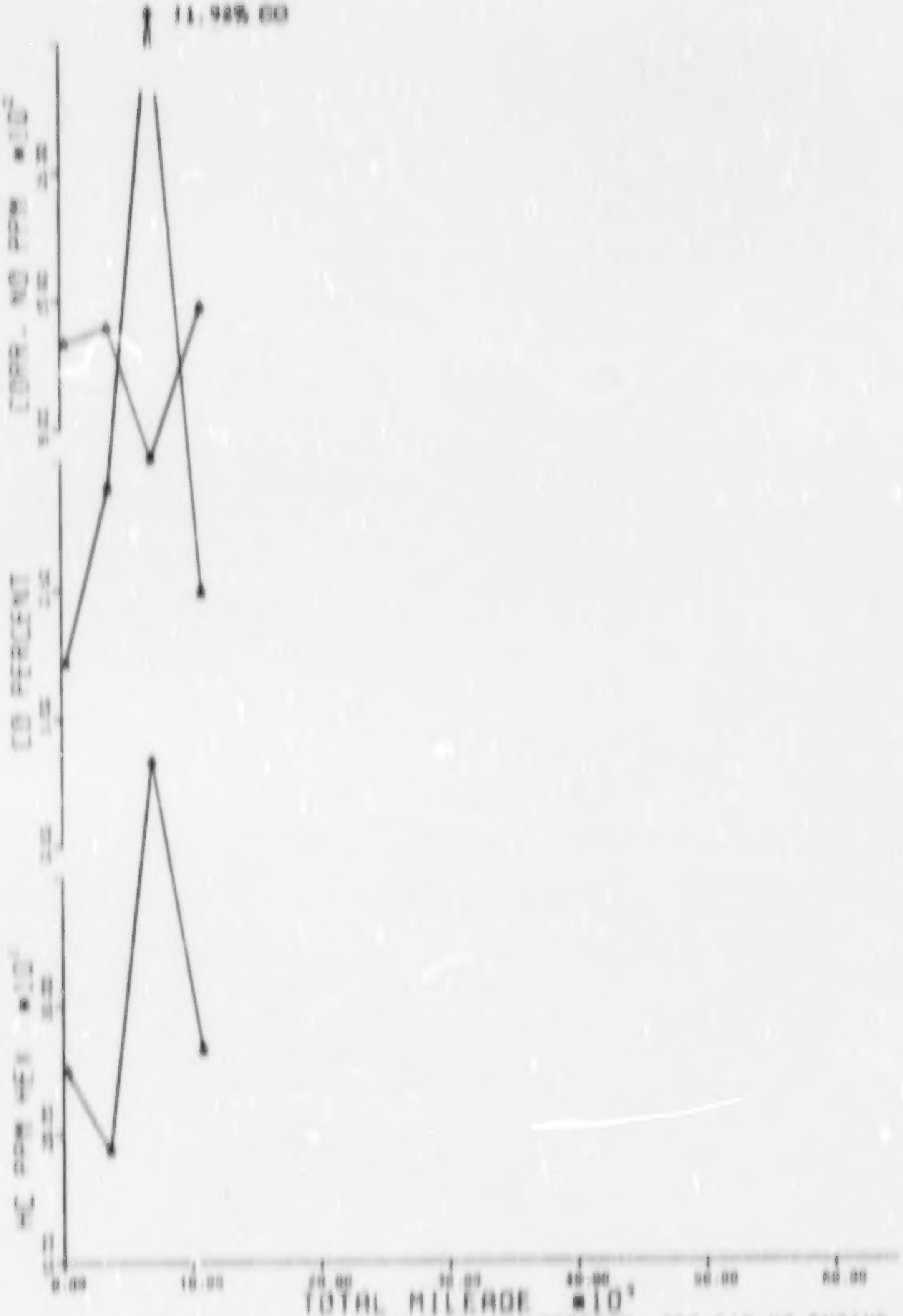


UNIT 130 71 IHC 34000 LB GVW GARBAGE 392 CID V8 ENGINE

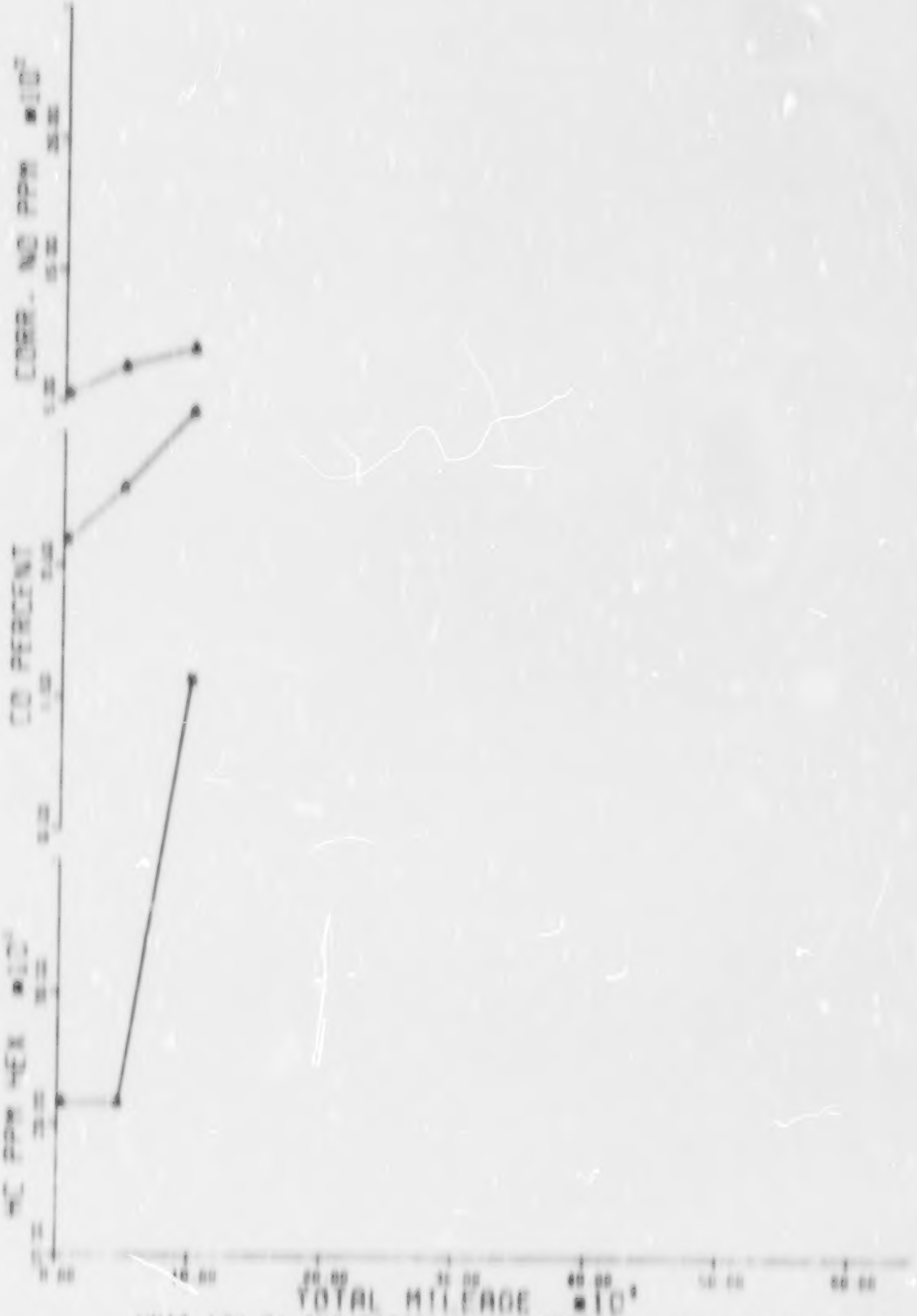


TOTAL MILEAGE *10^3

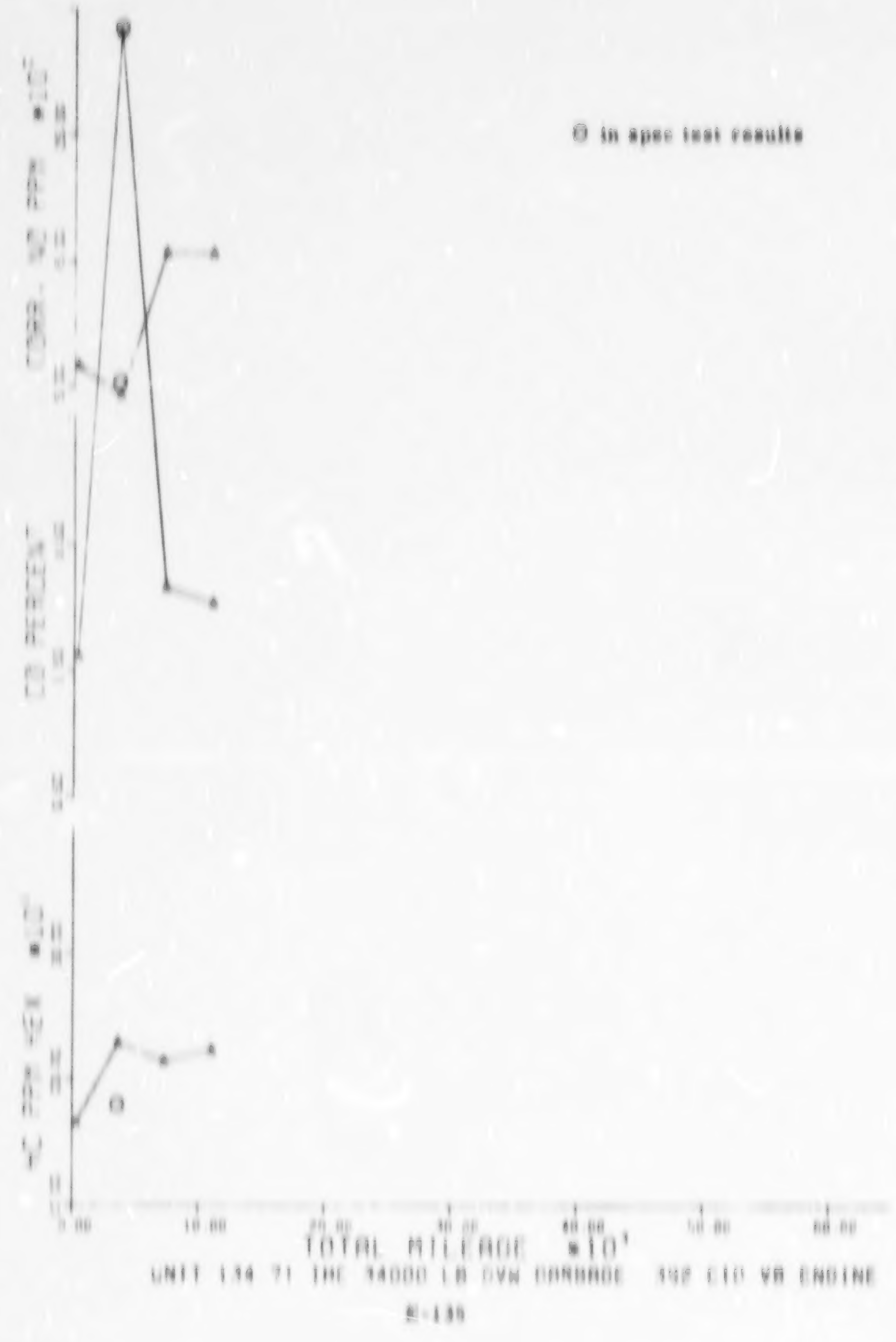
UNIT 131 71 IHC 34000 LB GVW GARBAGE 392 CID V8 ENGINE



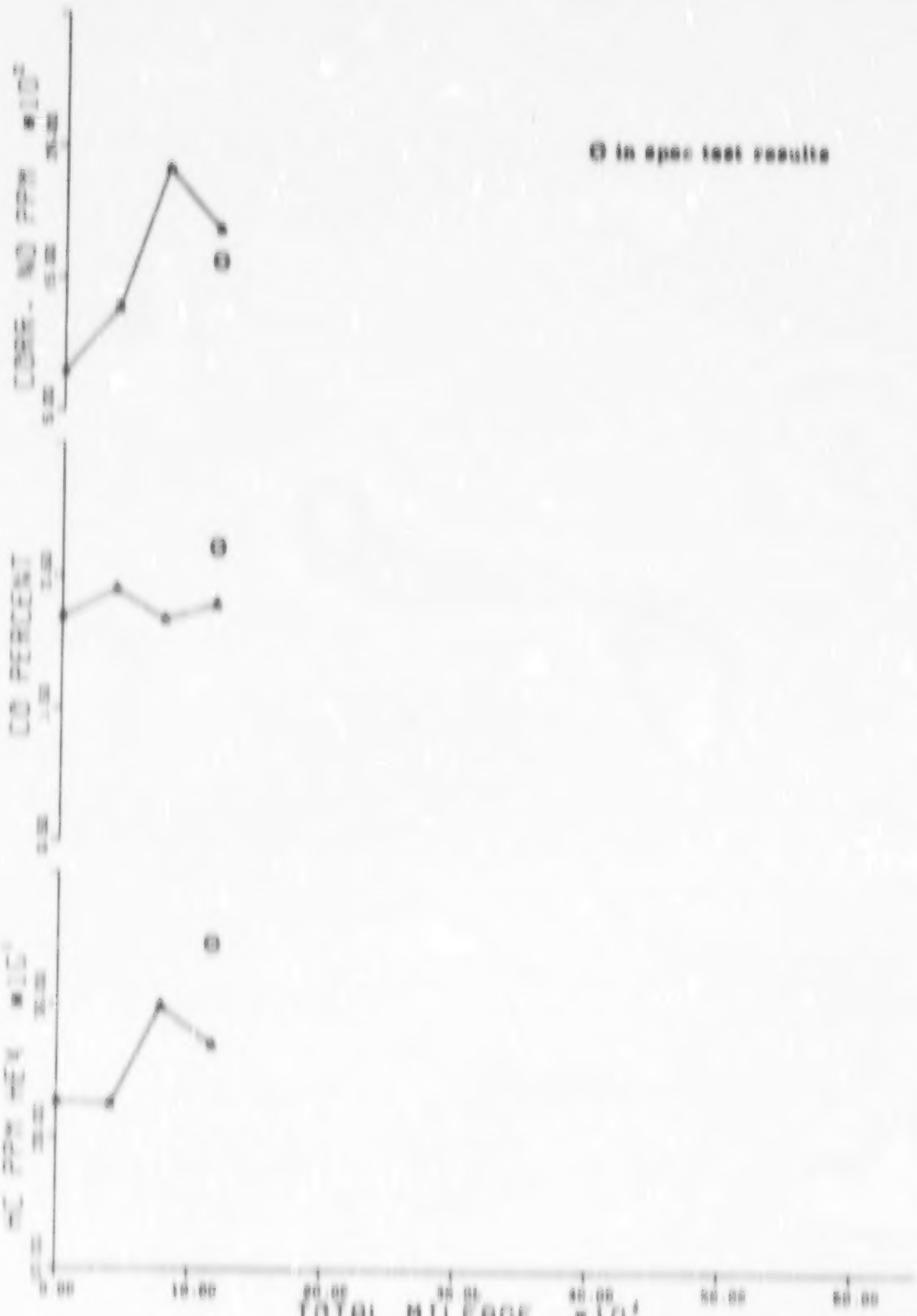
UNIT 132 71 IHC 34000 LB GVW GARBAGE 392 CID V8 ENGINE



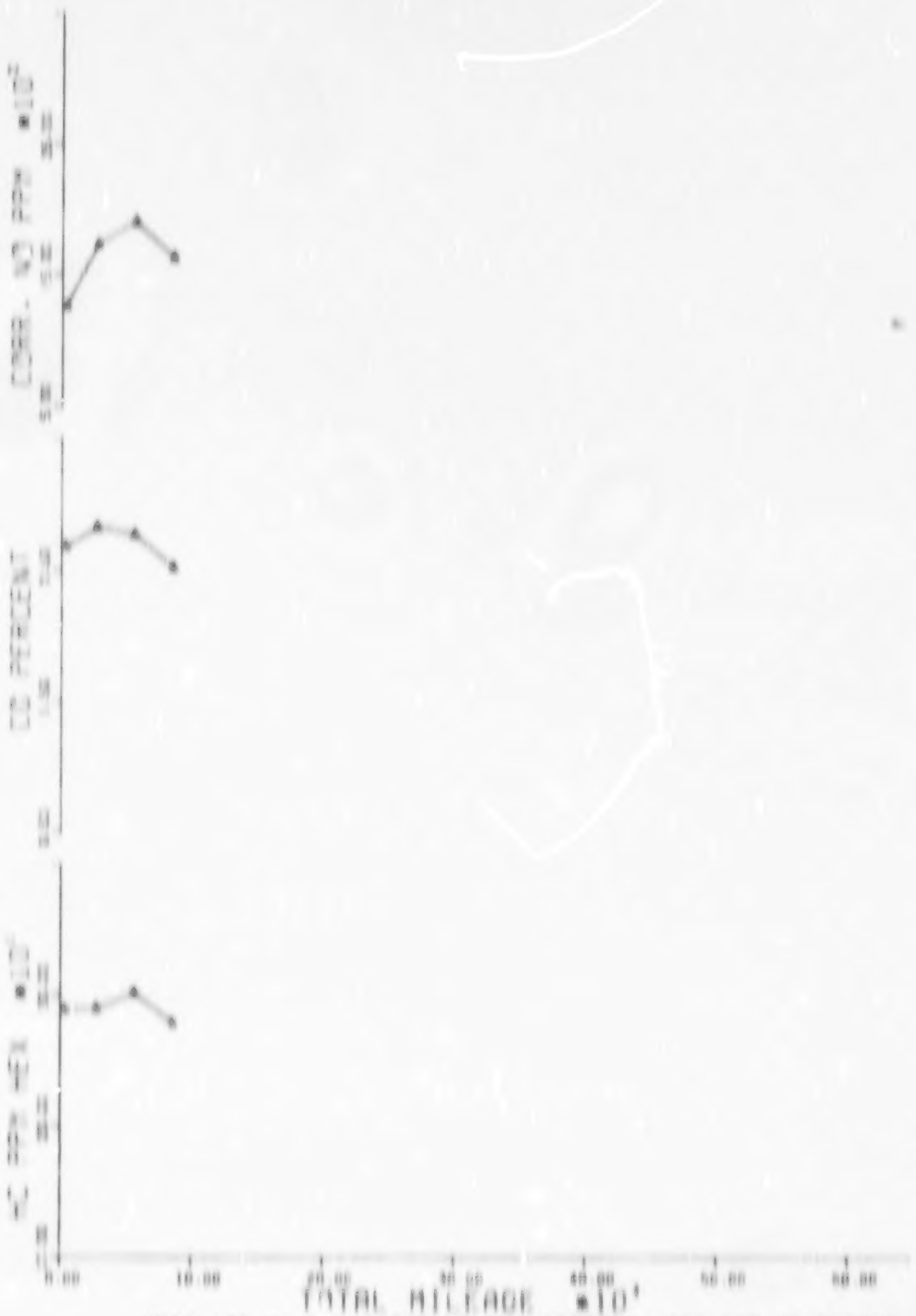
UNIT 133 71 IHC 34000 LB GVW GARBAGE 392 CID V8 ENGINE



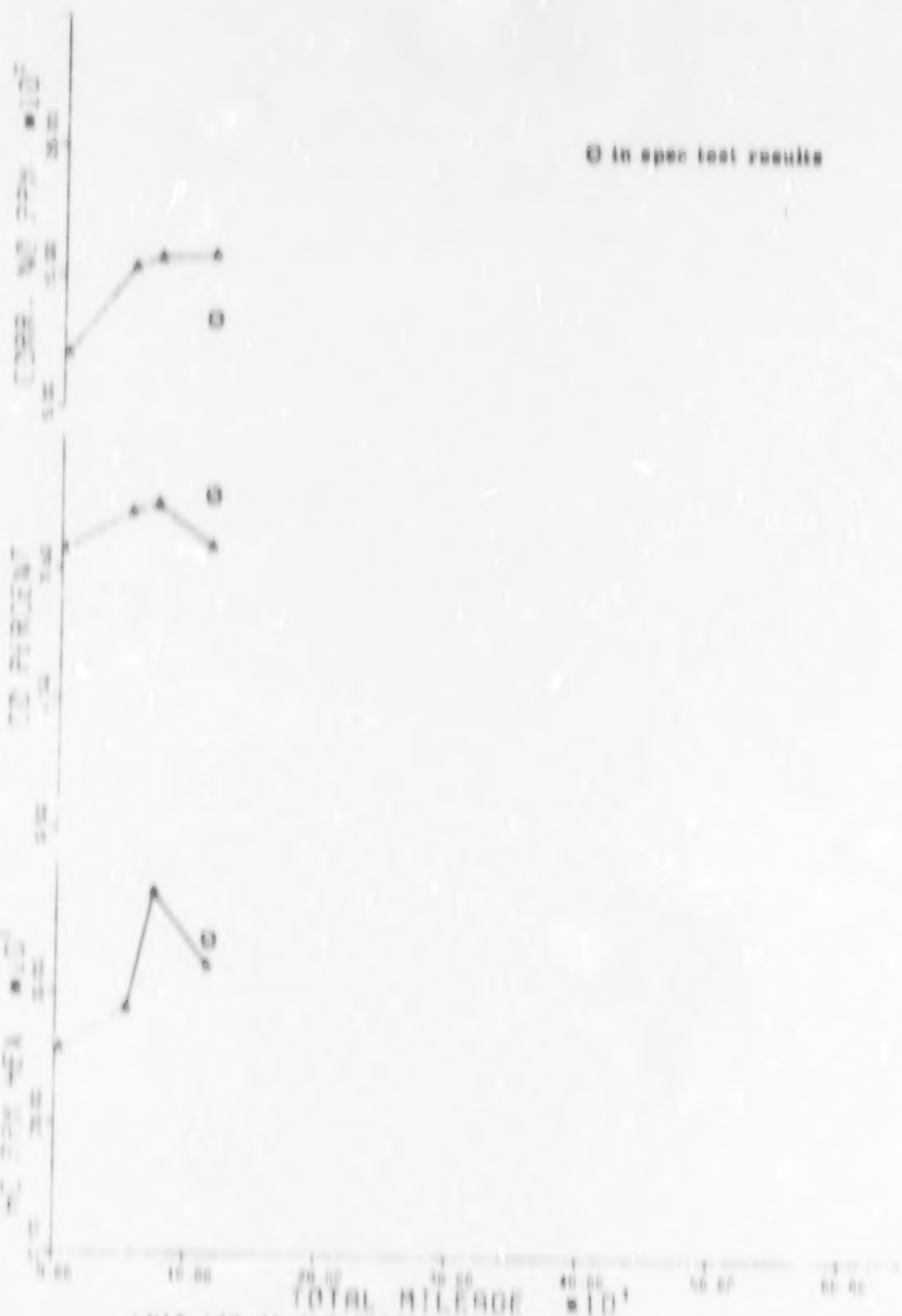
UNIT 134 71 IHC 14000 LB GVW GARBAGE 392 CID V8 ENGINE



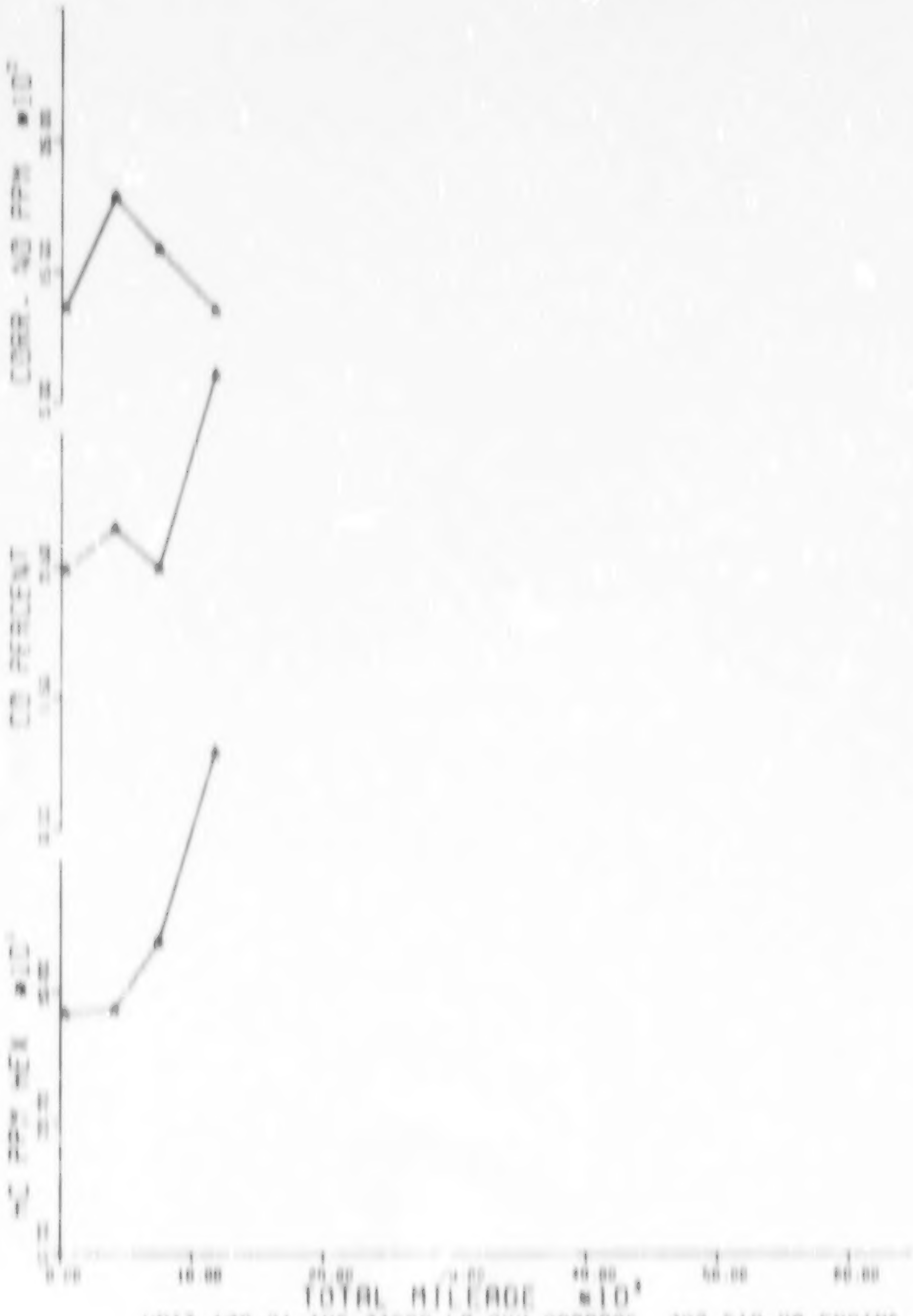
UNIT 135 71 IHC 34000 LB GVW GARBAGE 392 CID V8 ENGINE



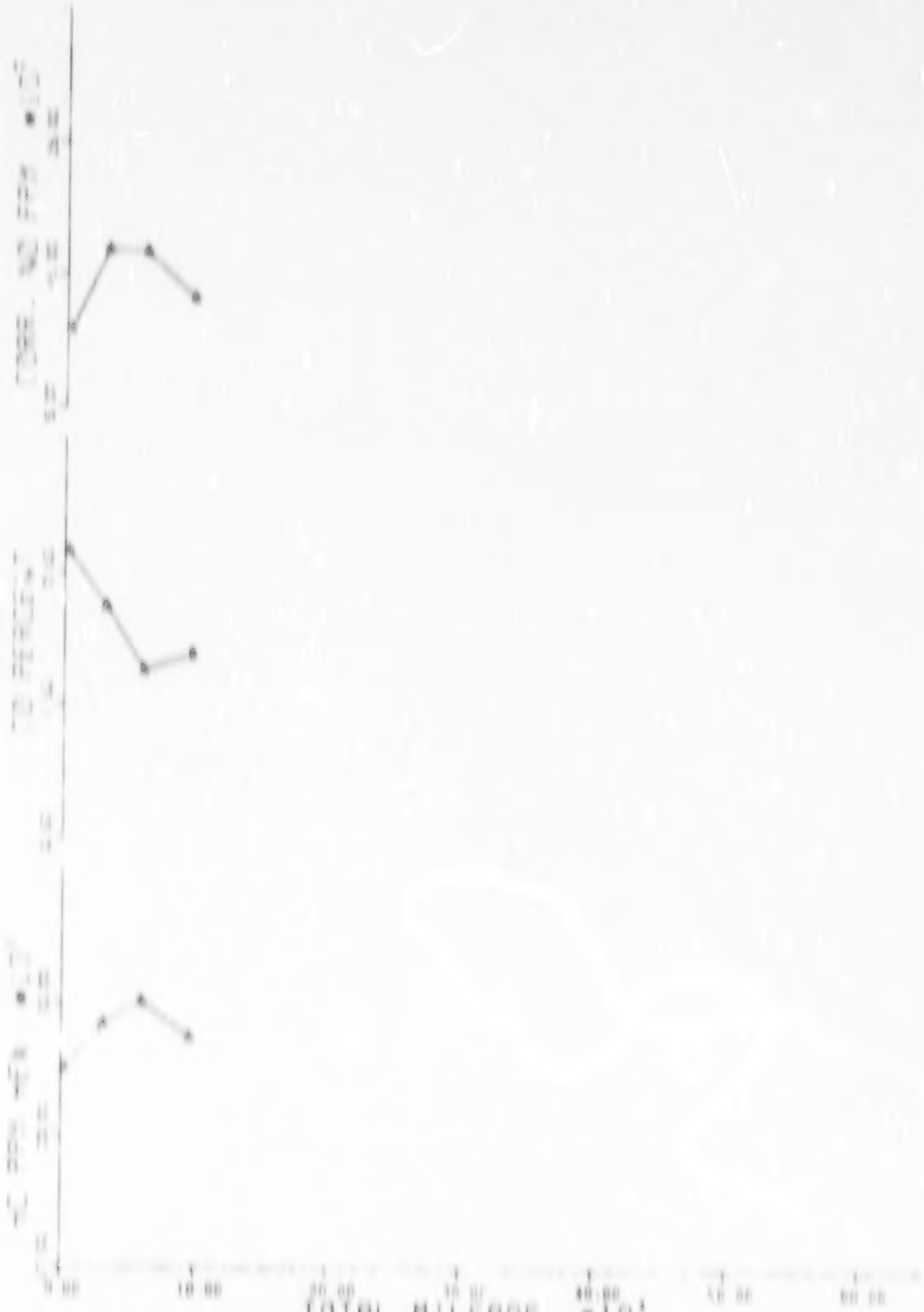
UNIT 136 71 I.C 34000 LB GVW GARBAGE 352 CID V8 ENGINE



UNIT 137 71 IHC 34000 LB GVW GARBAGE 392 CID V8 ENGINE

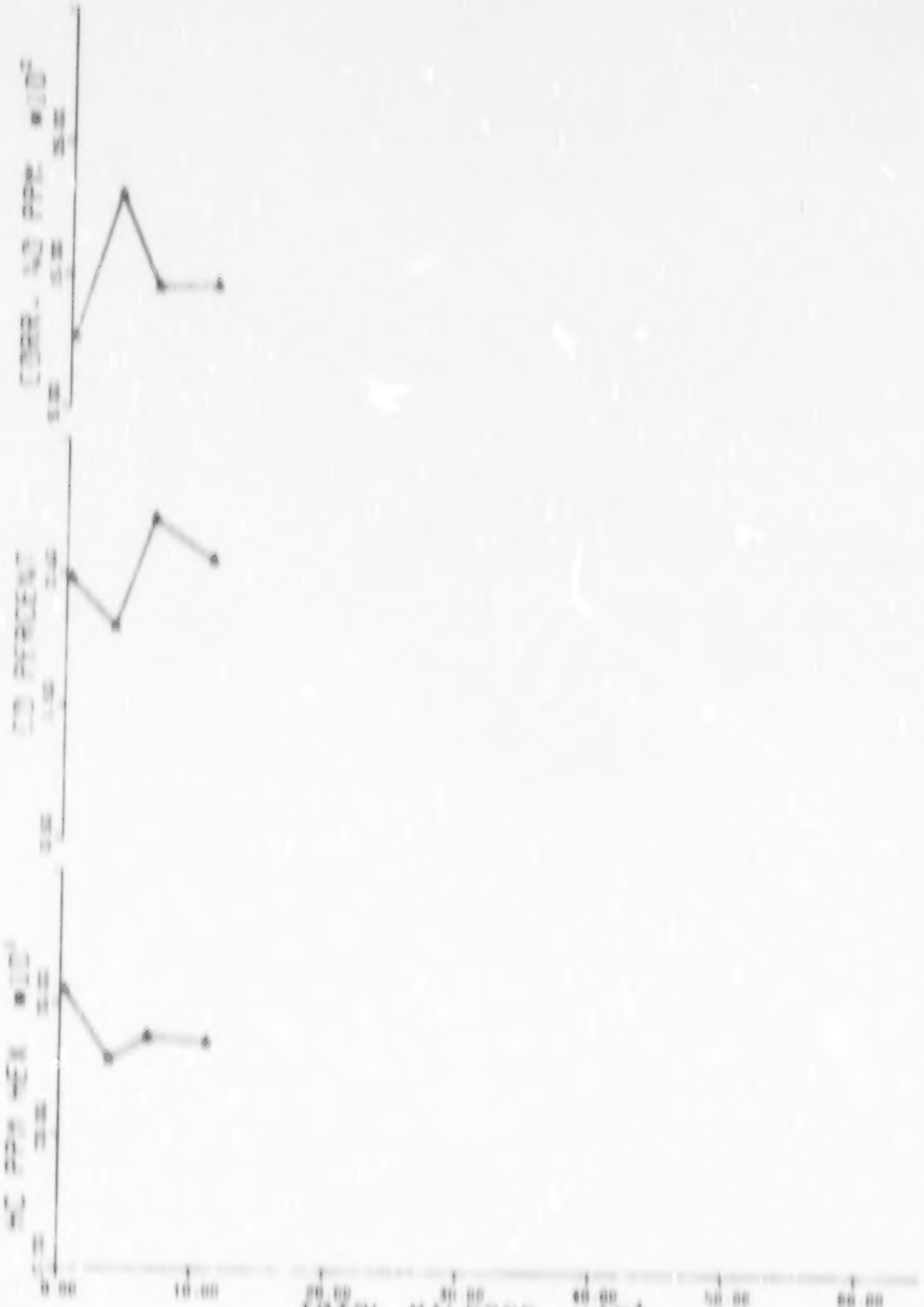


UNIT 138 71 IHC 34000 LB GVW GARBAGE 392 CID V8 ENGINE

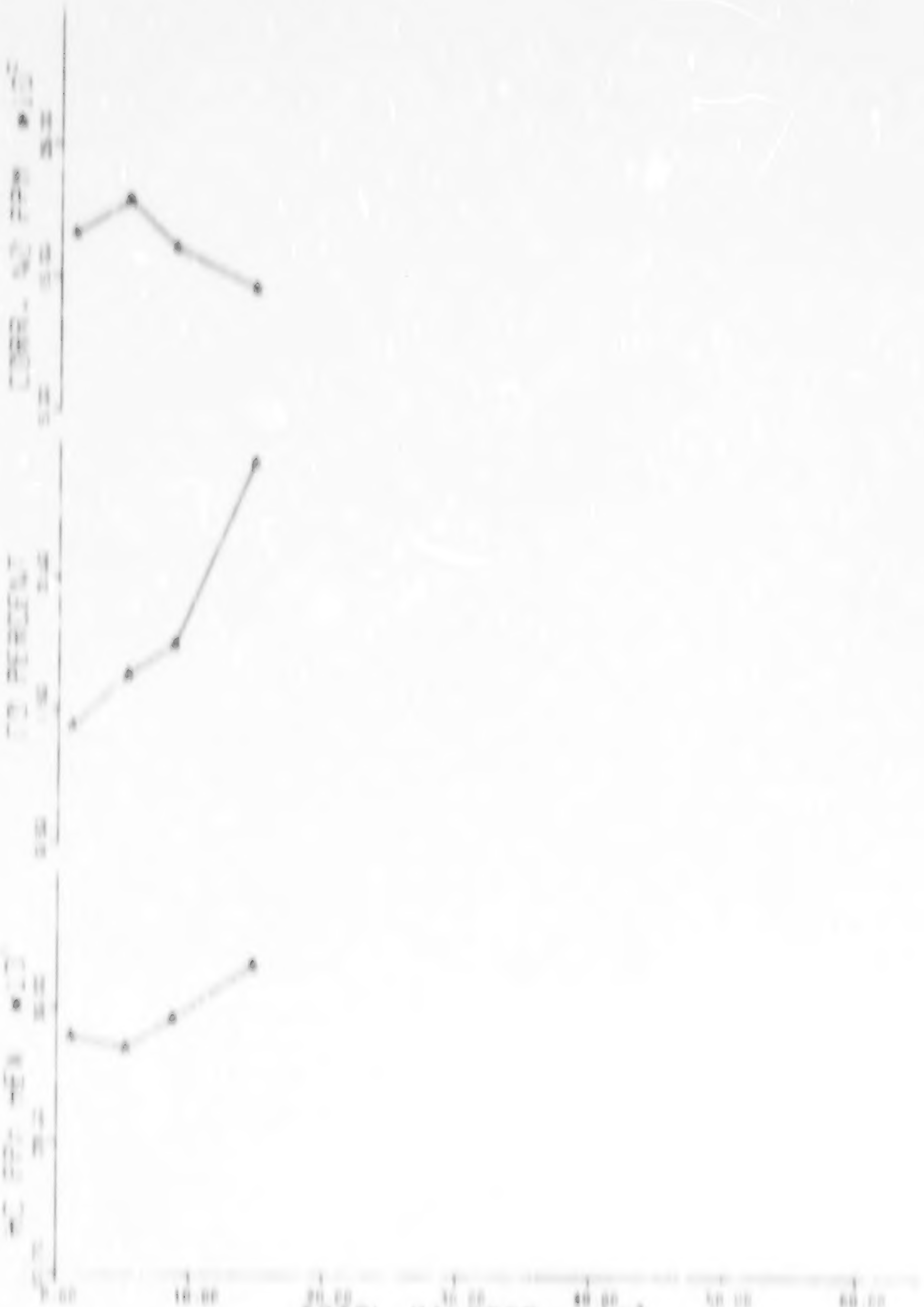


TOTAL MILEAGE *10³

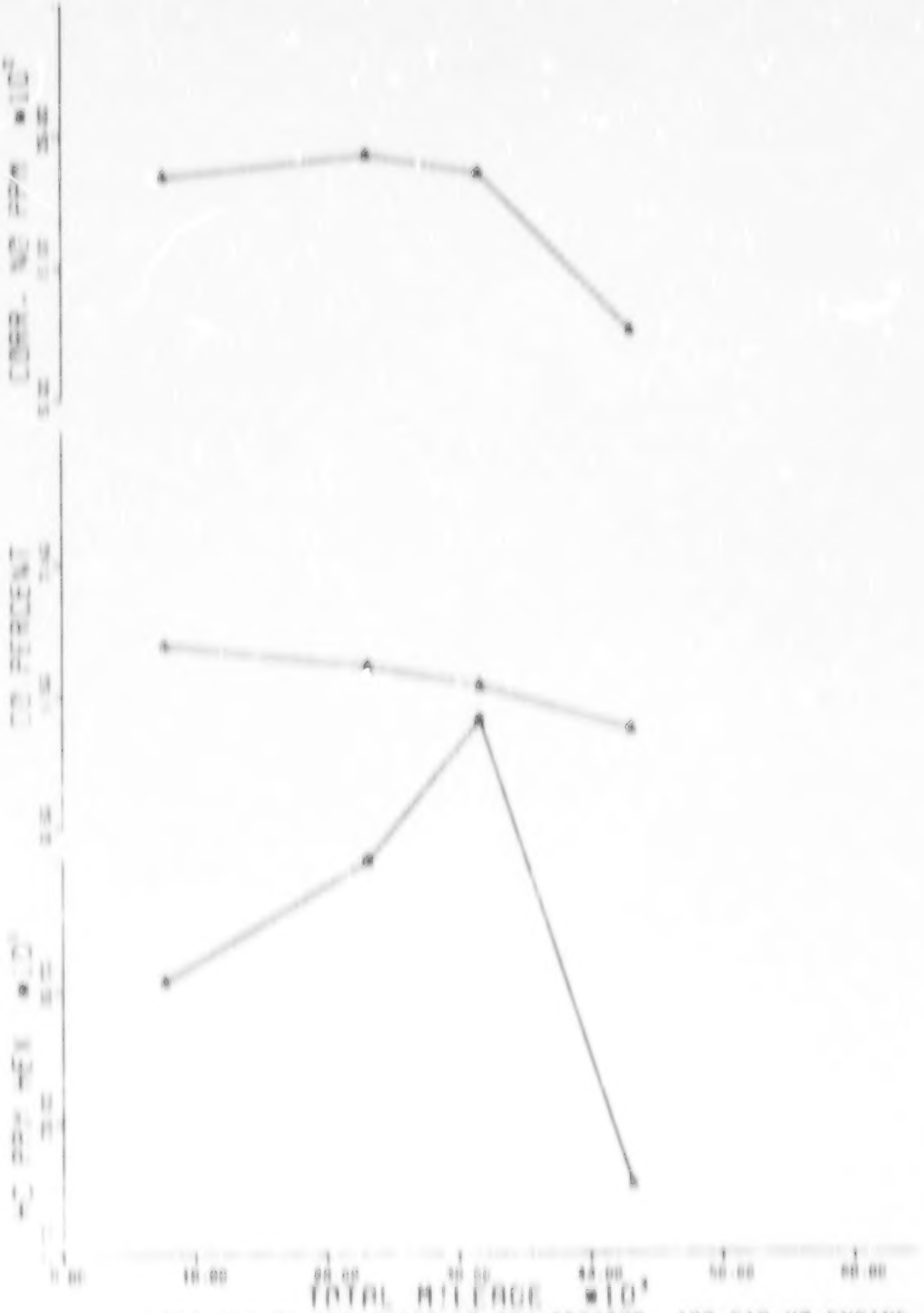
UNIT 139 71 IHC 34000 LB GVW GARBAGE 392 CID V8 ENGINE



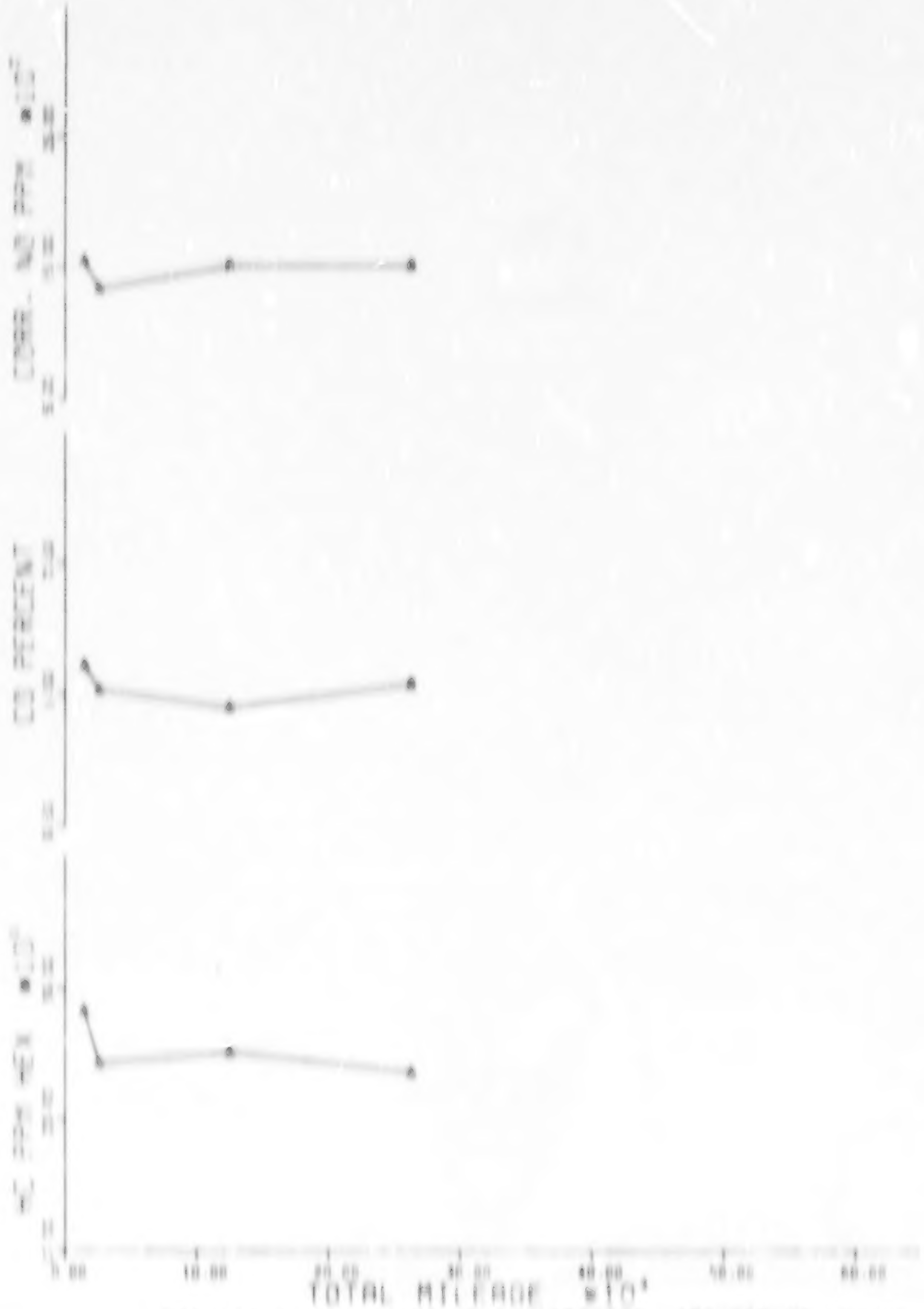
UNIT 140 71 IHC 34000 LB GVW GARBAGE 392 CID V8 ENGINE



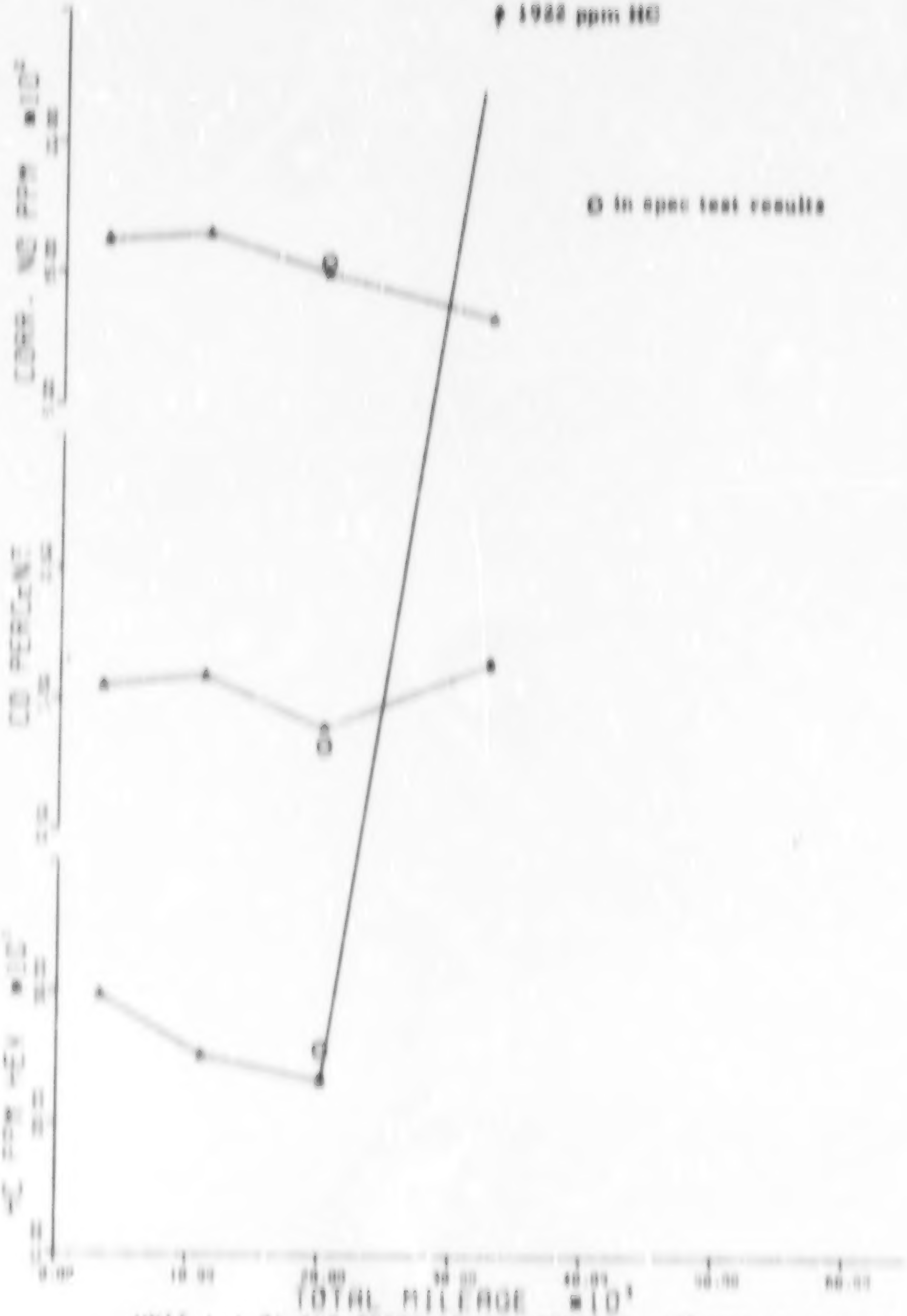
UNIT 141 71 FORD 27500 LB GVW DELIVERY 391 CID V8 ENGINE



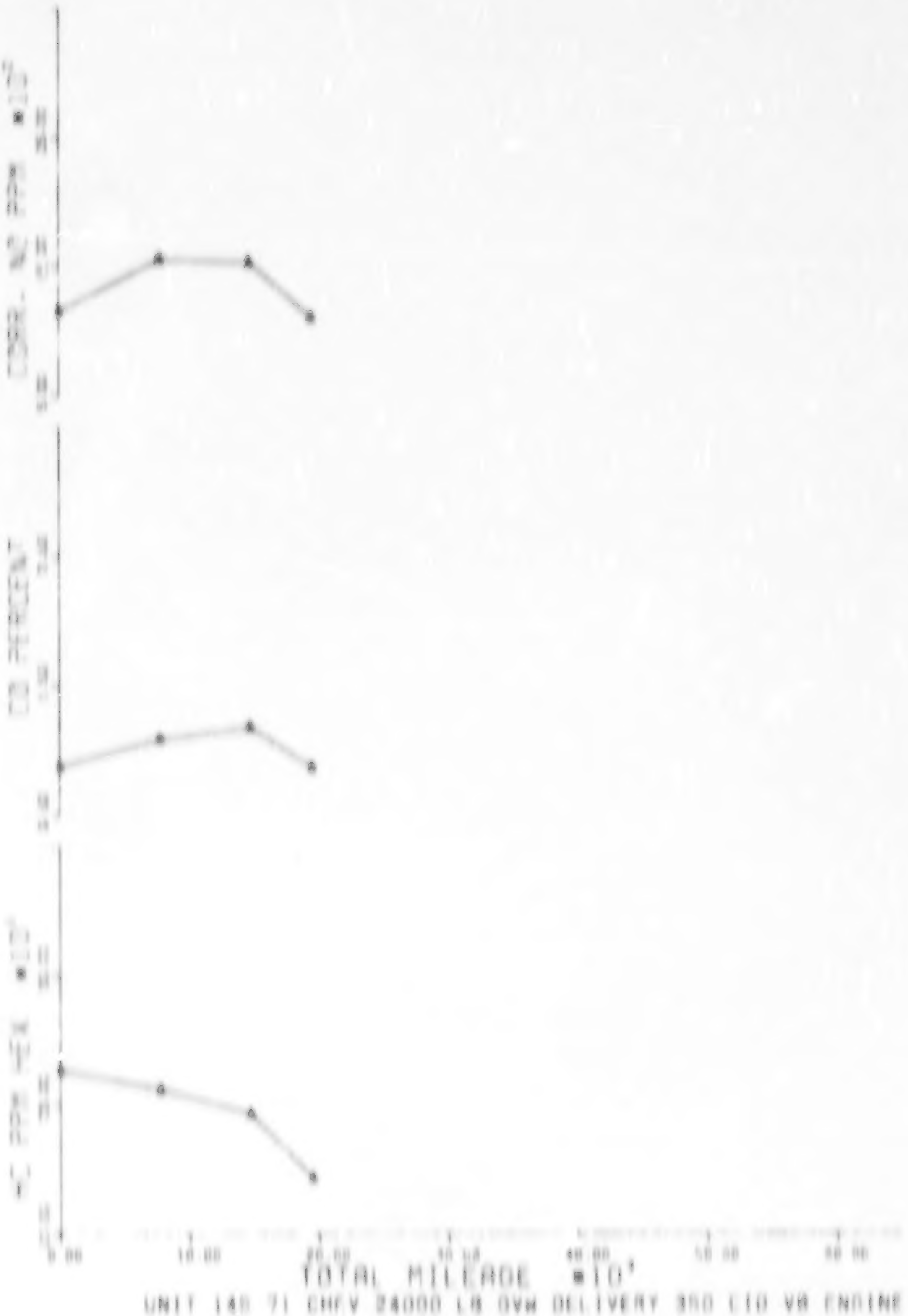
UNIT 142 71 IHC 32000 LB GVW TRACTOR 478 CID V8 ENGINE



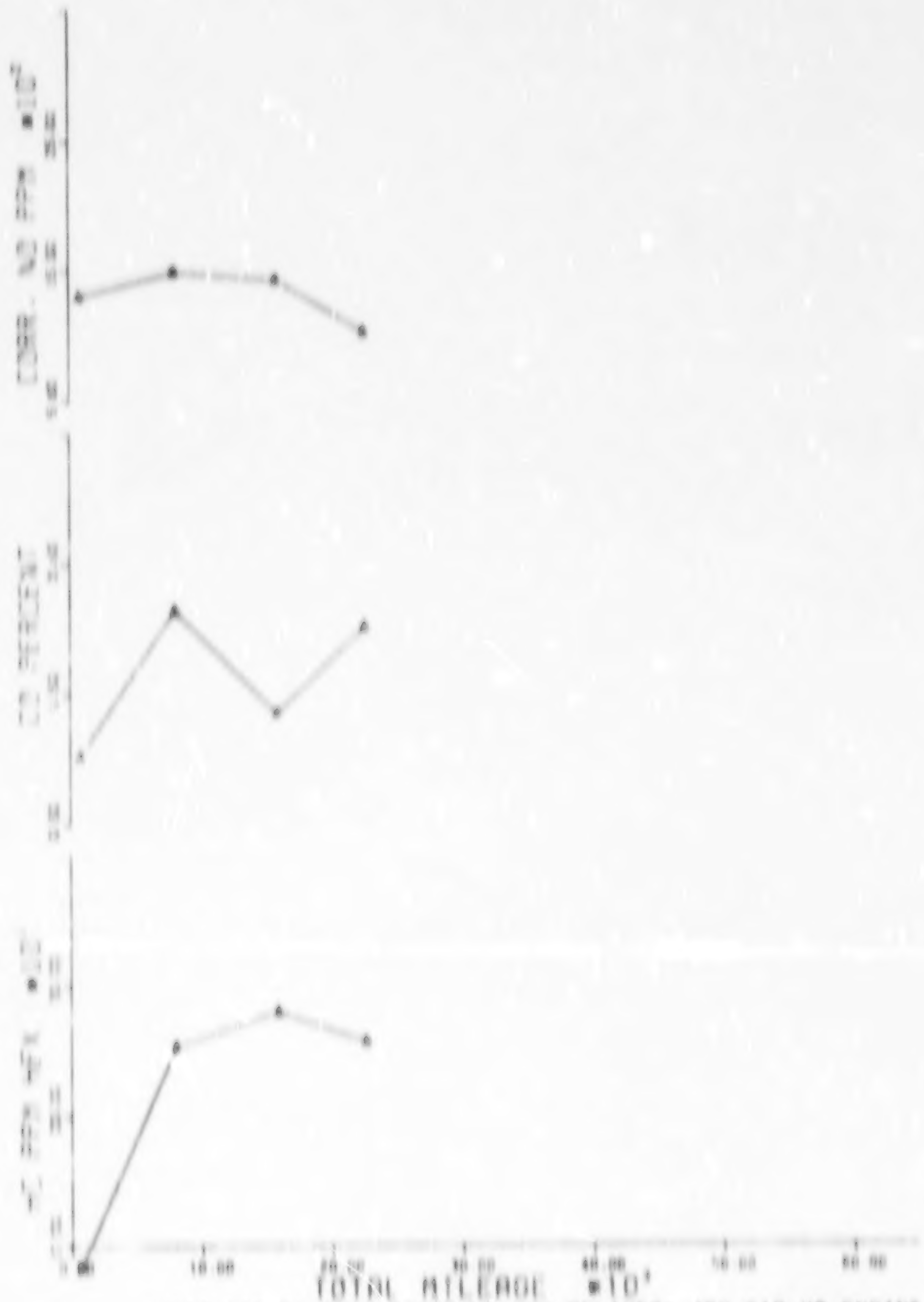
UNIT 143 71 IHC 72000 LB GVW TRACTOR 478 CID V8 ENGINE



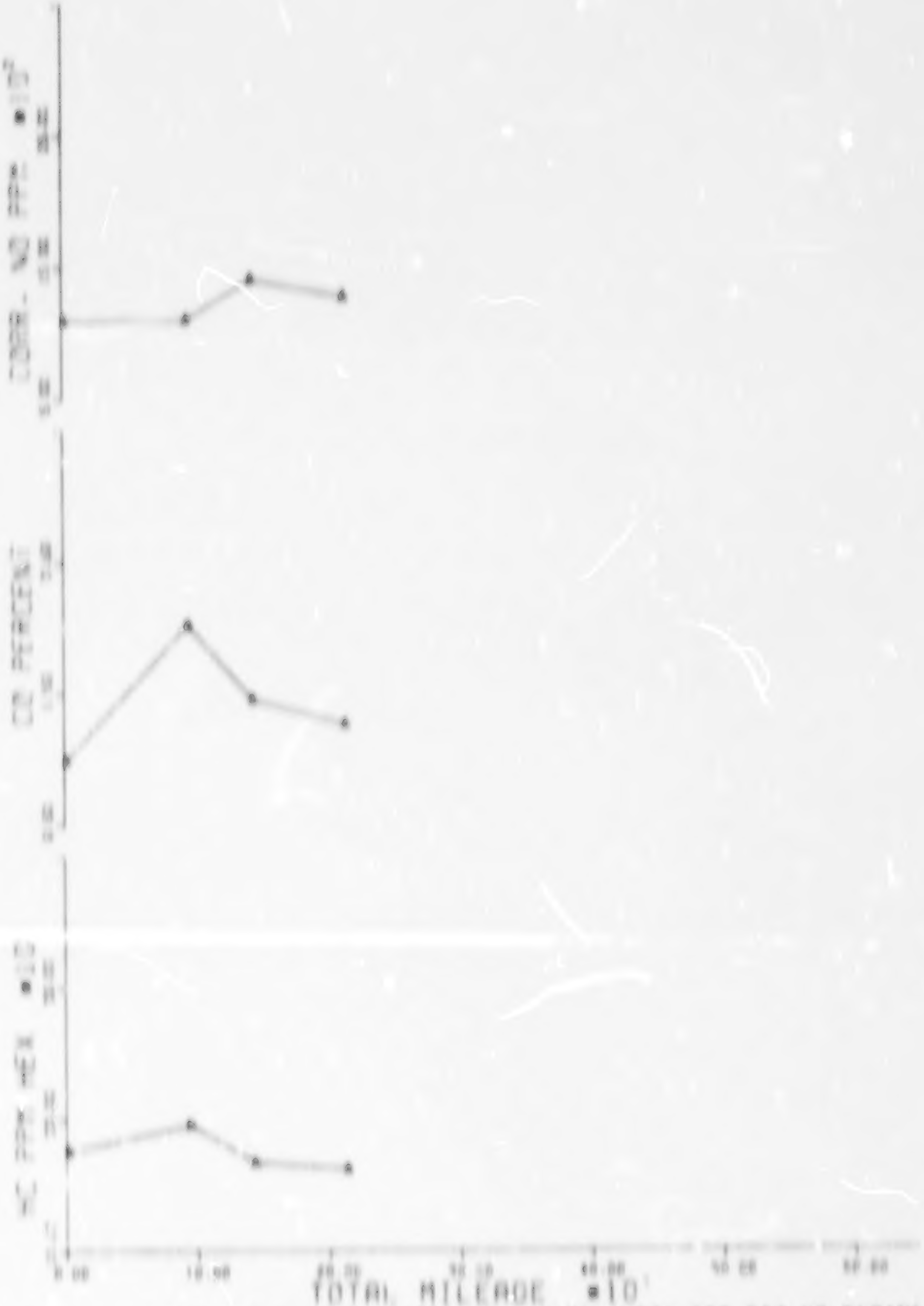
UNIT 1-4 71 IHC 32000 LB GVW TRACTOR 478 CID V8 ENGINE



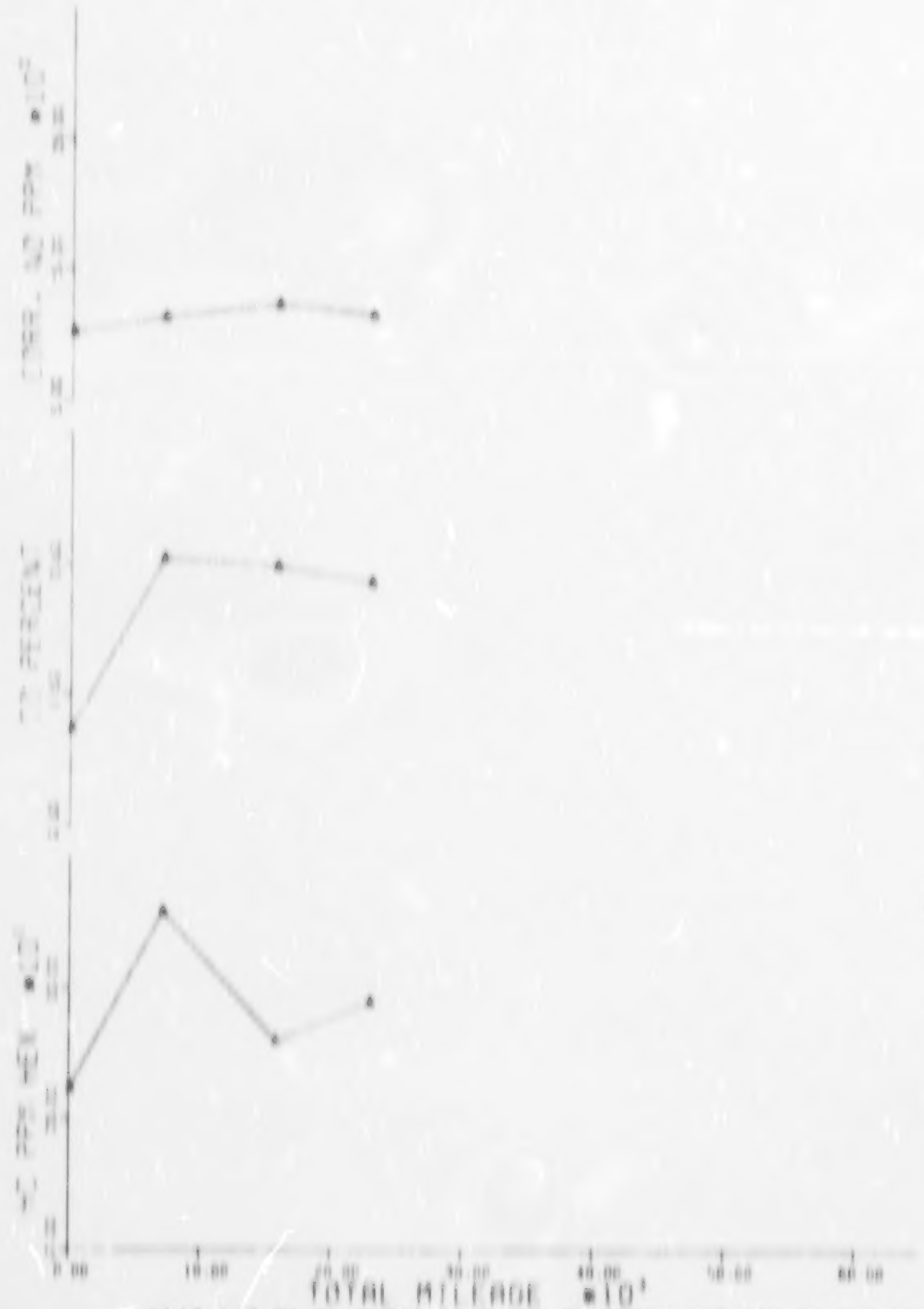
UNIT 145 71 CHEV 24000 LB GVW DELIVERY 350 CID V8 ENGINE



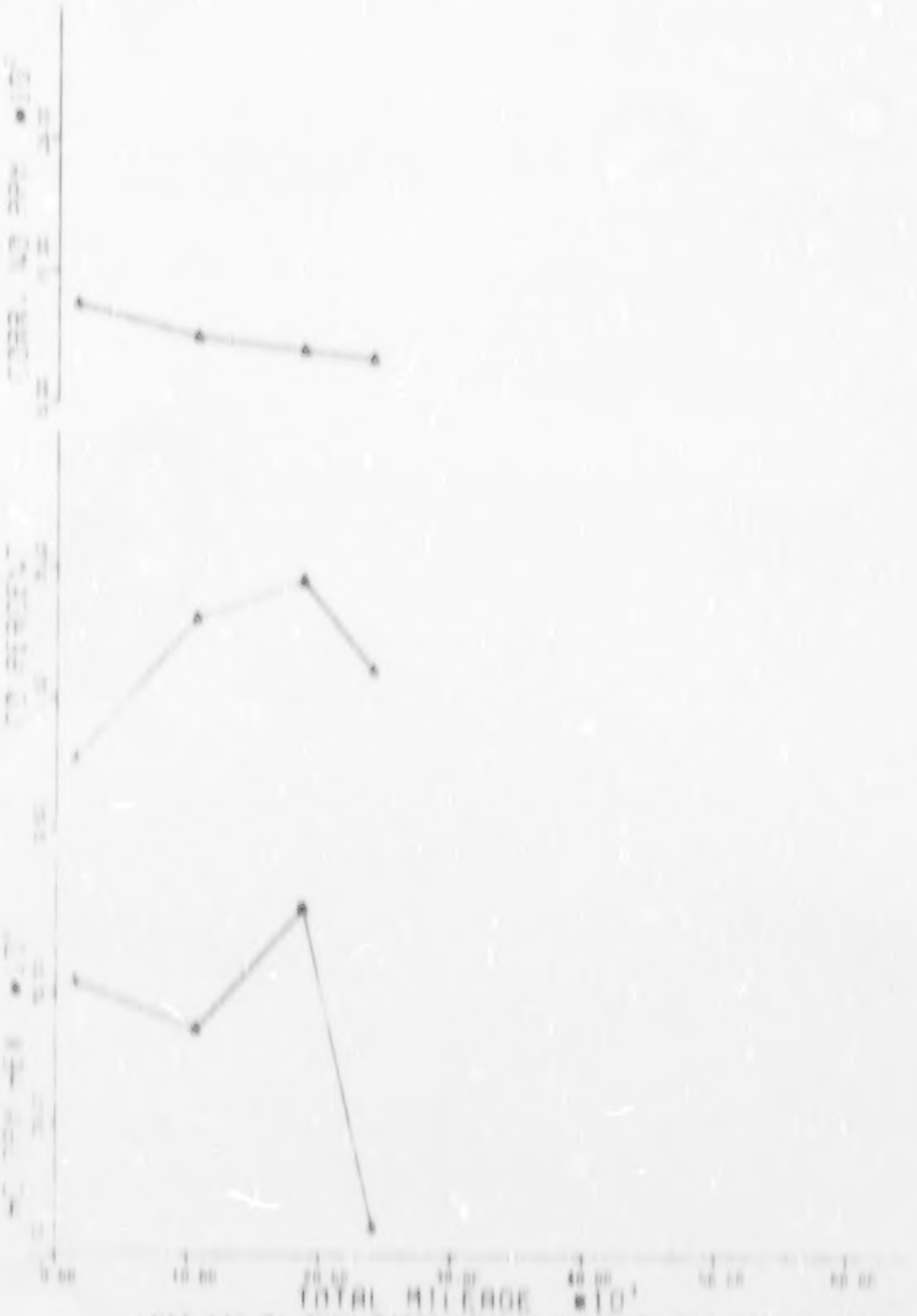
UNIT 146 71 CHEV 24000 LB 5YW DELIVERY 350 CID V8 ENGINE



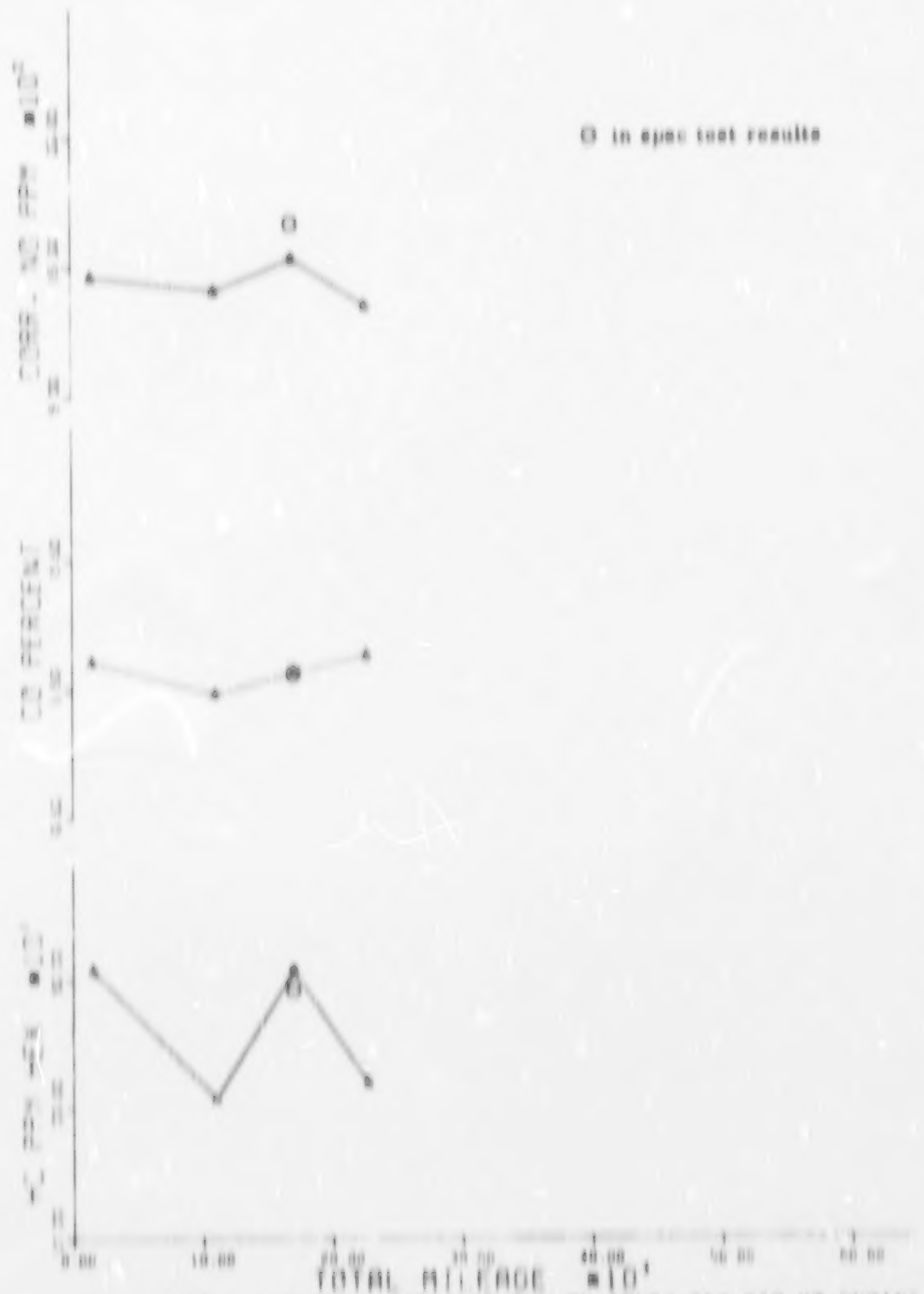
UNIT 147 71 CHEV 24000 LB GVW DELIVERY 350 CID V8 ENGINE



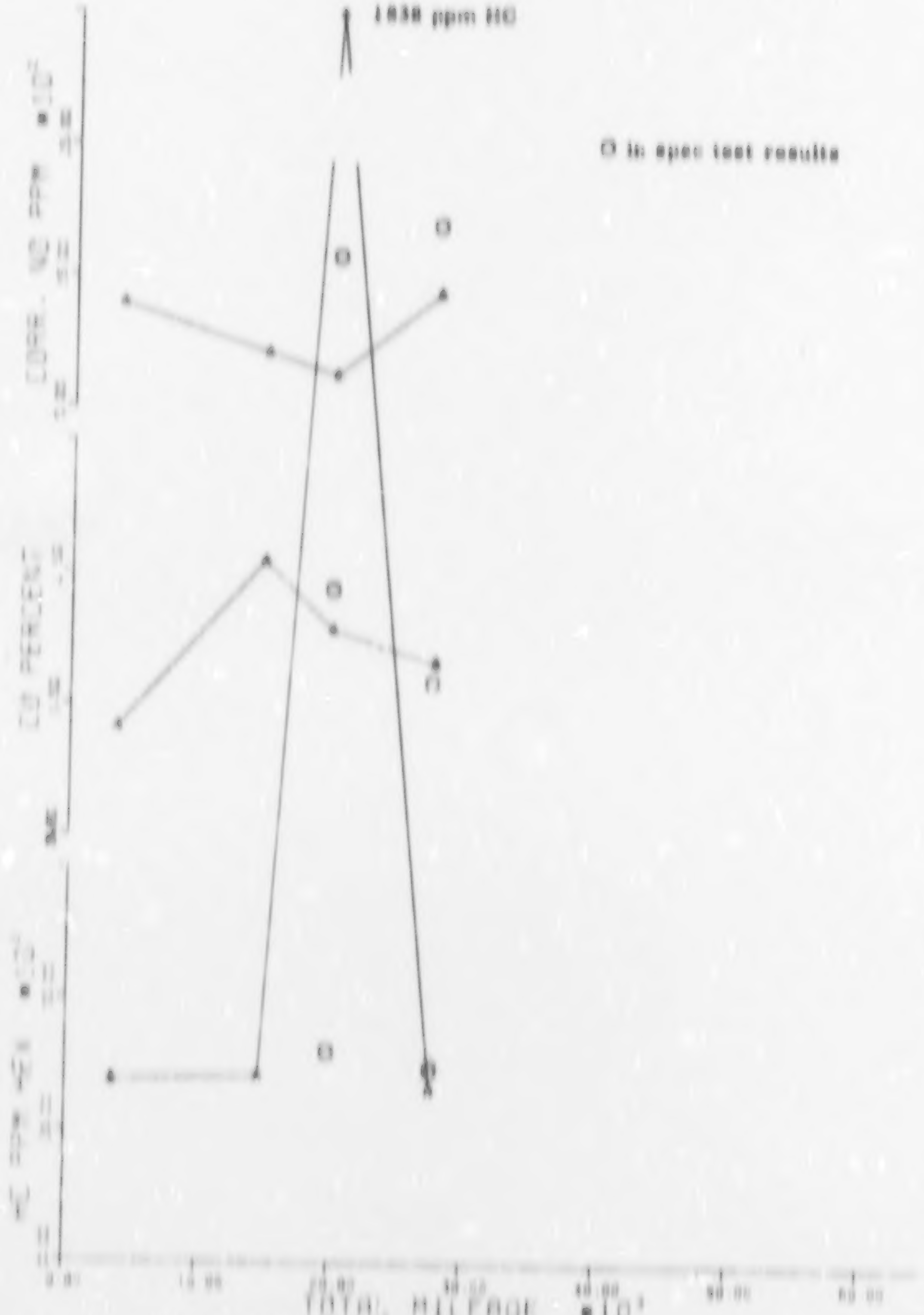
UNIT 14B 71 CHEV 24000 LB GVW DELIVERY 350 CID V8 ENGINE



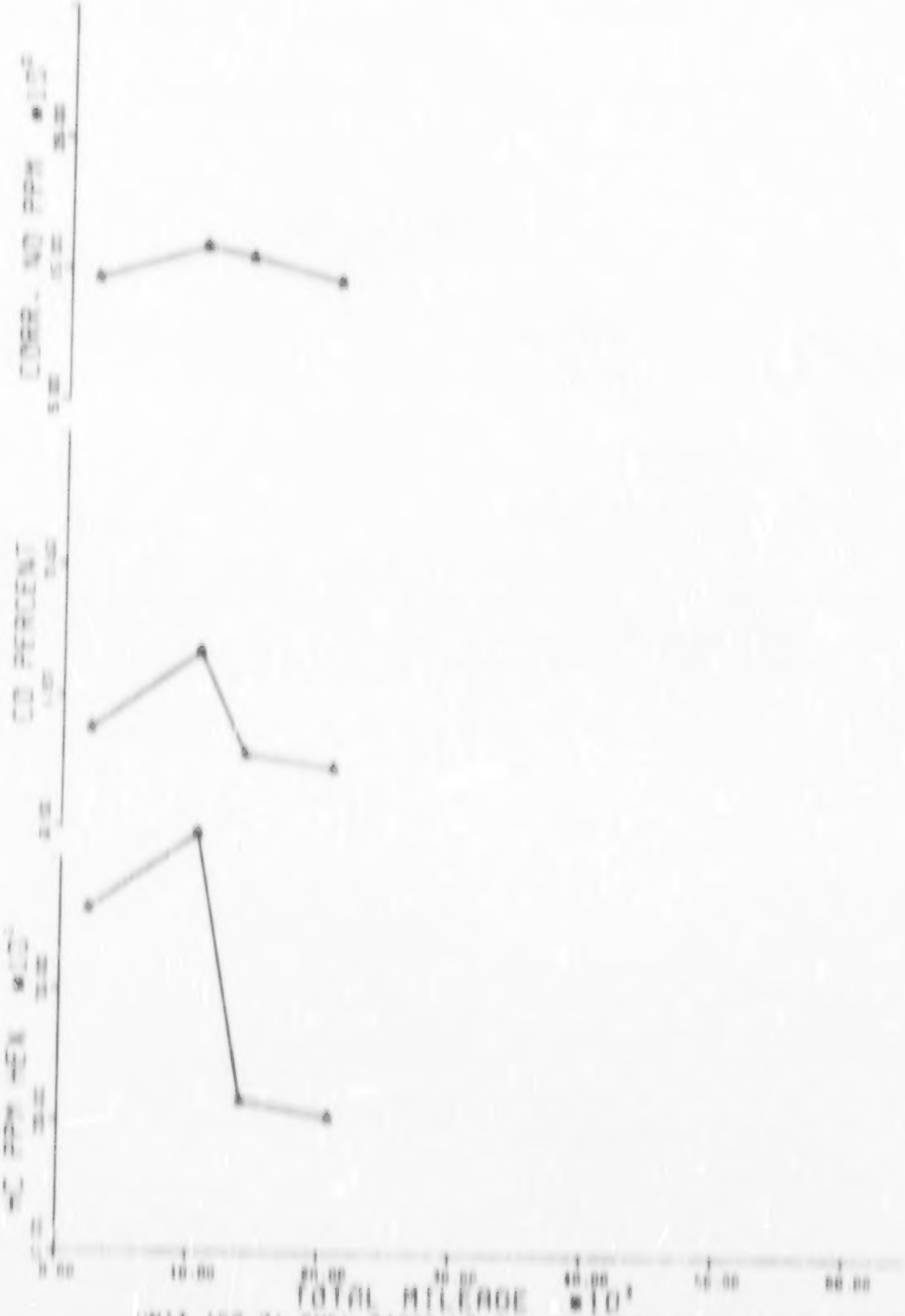
UNIT 149 71 CHEV 24000 LB GVW DELIVERY 350 CID V8 ENGINE



UNIT 150 71 CHEV 24000 LB GVW DELIVERY 350 CID V8 ENGINE



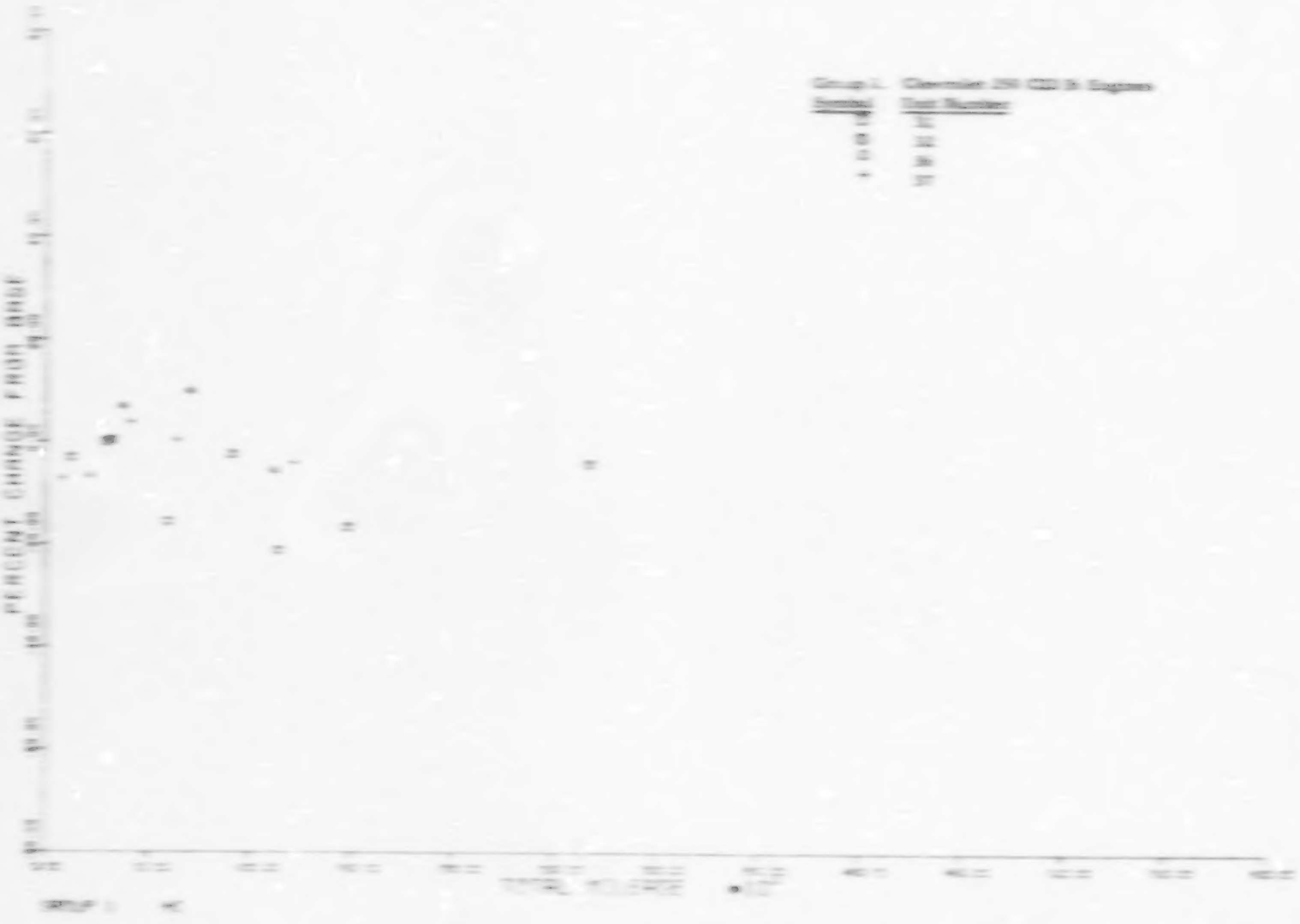
UNIT 151 71 CHEV 32000 LB GVW TRACTOR 427 CID V8 ENGINE

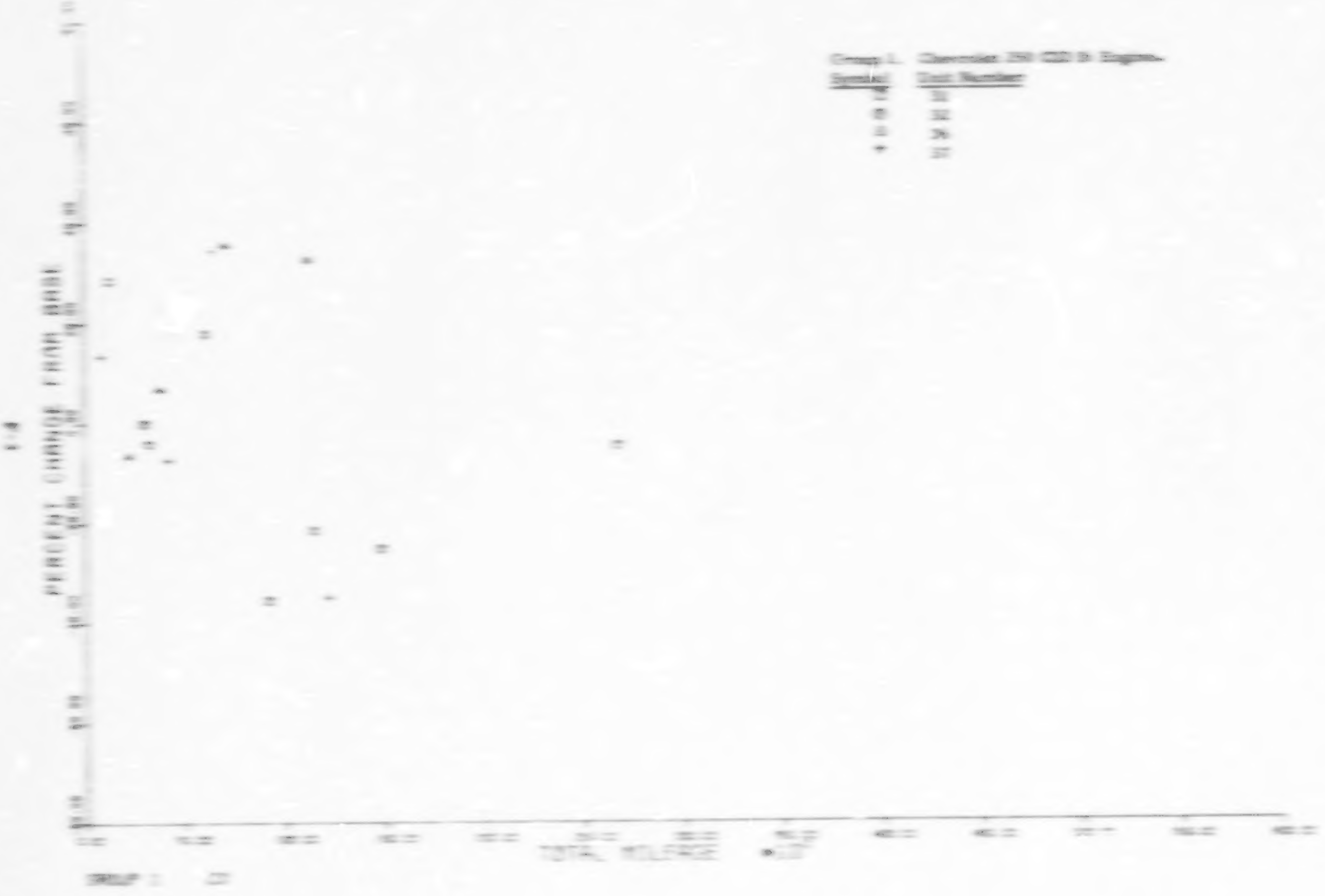


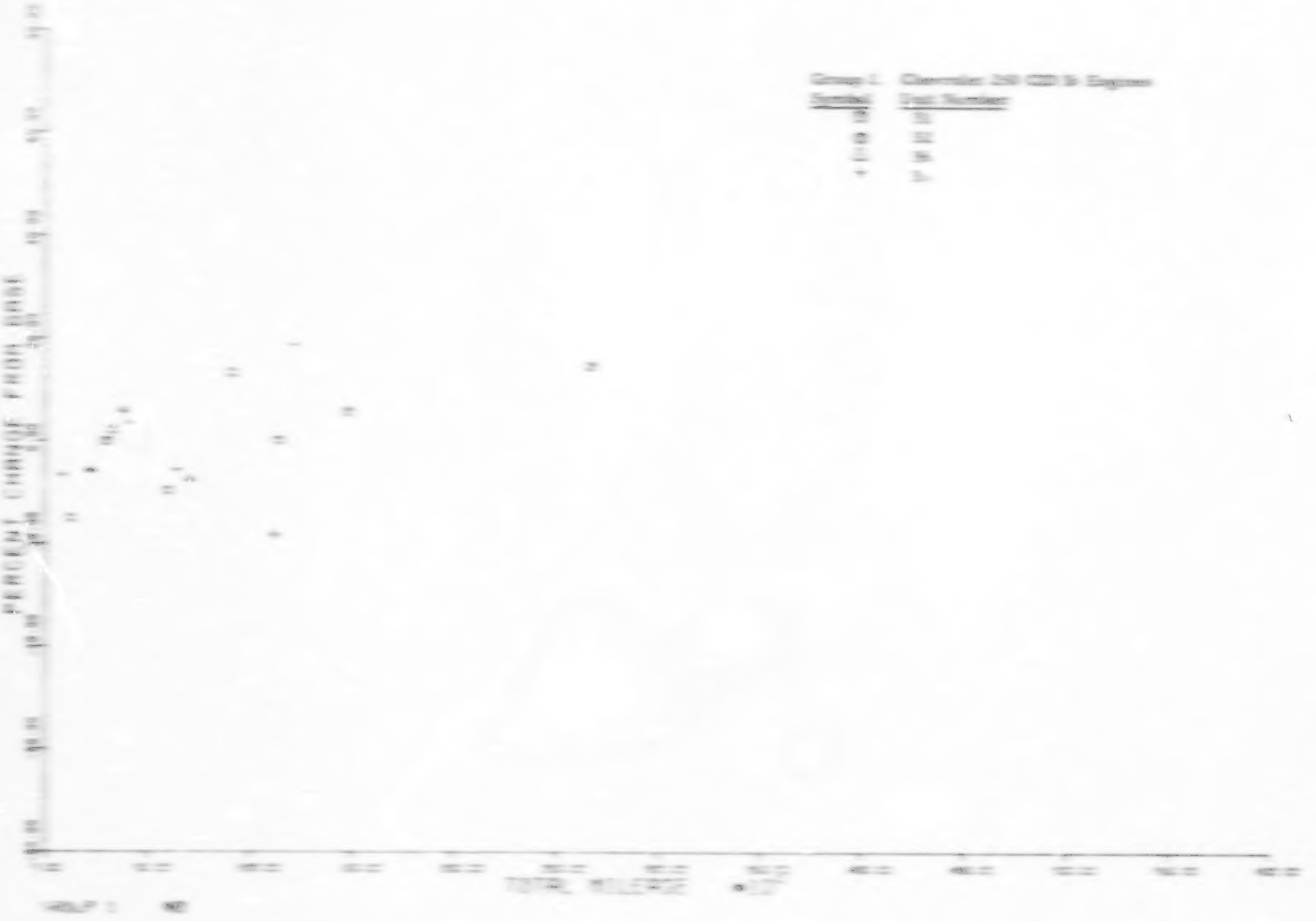
UNIT 182 71 CHEV 24000 LB GVW DELIVERY 350 CID V8 ENGINE

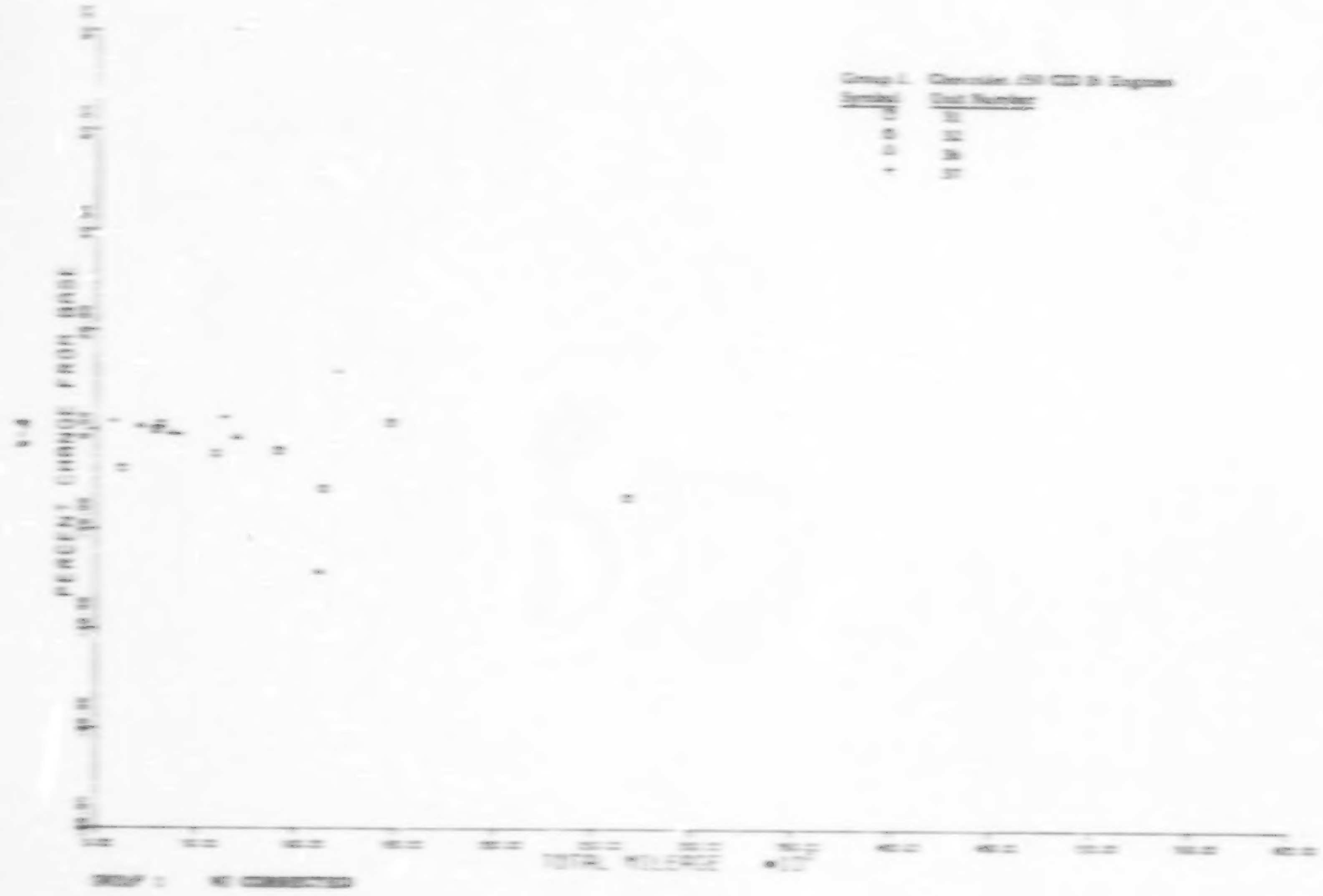
APPENDIX F

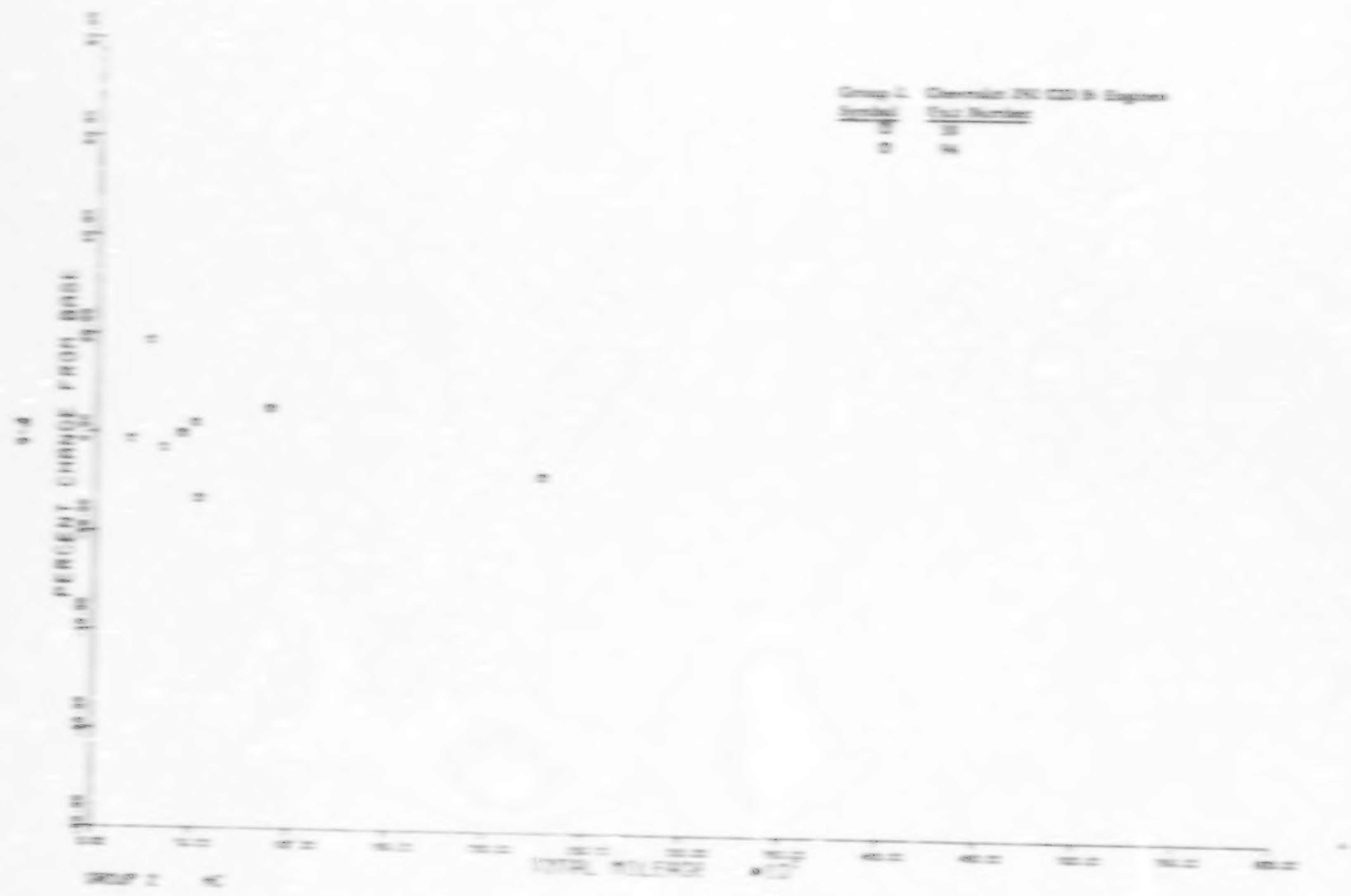
PLOTS OF EMISSION LEVEL CHANGES WITH MILEAGE BY ENGINE MODEL GROUP

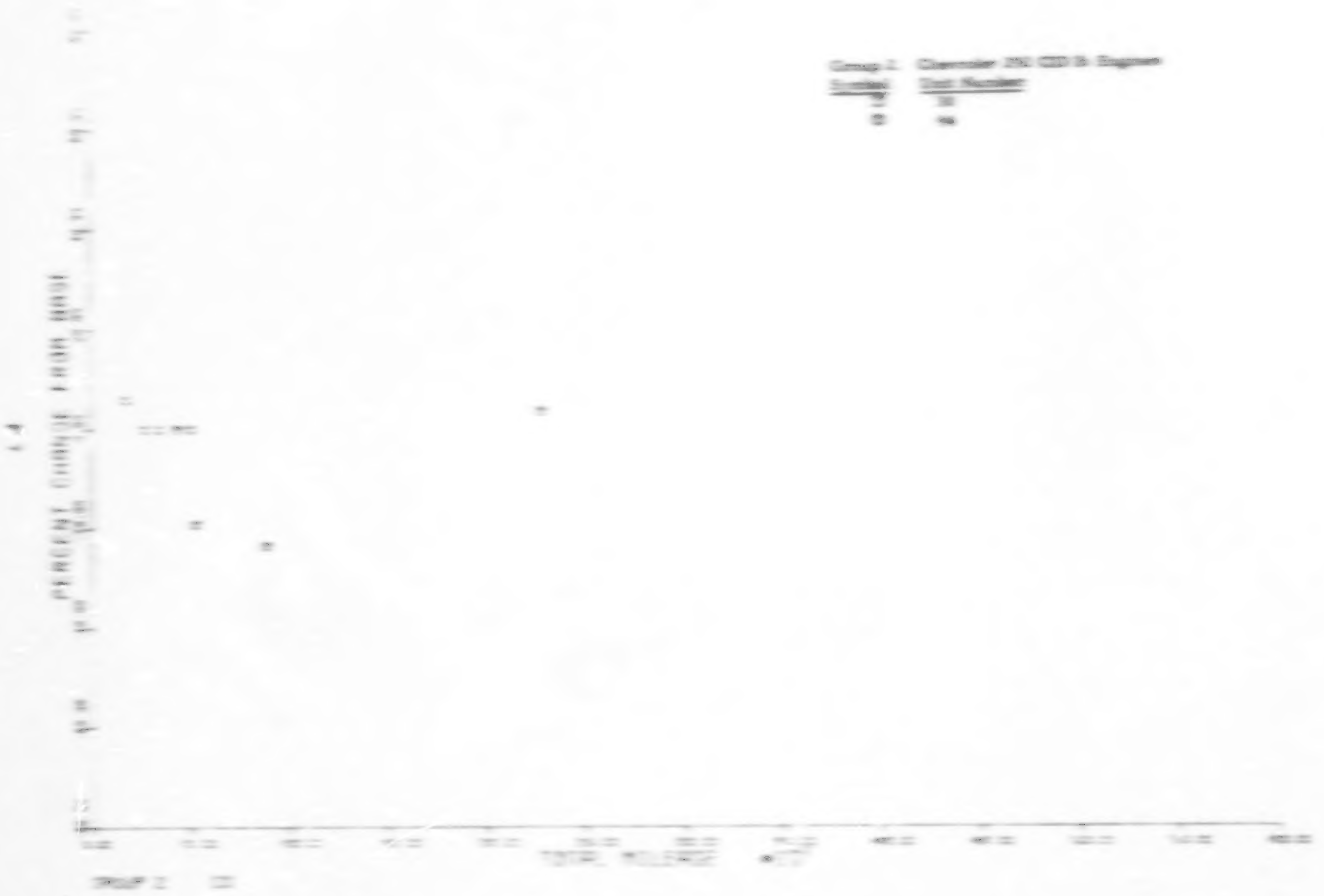

Group 1. Chevrolet 250 CID [illegible] Engines
Symbol Unit Number
31
32
36
37
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 1 HC


Group 1. Chevrolet 250 CID 6 Engine
Symbol Unit Number
31
32
36
37
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 1 CO

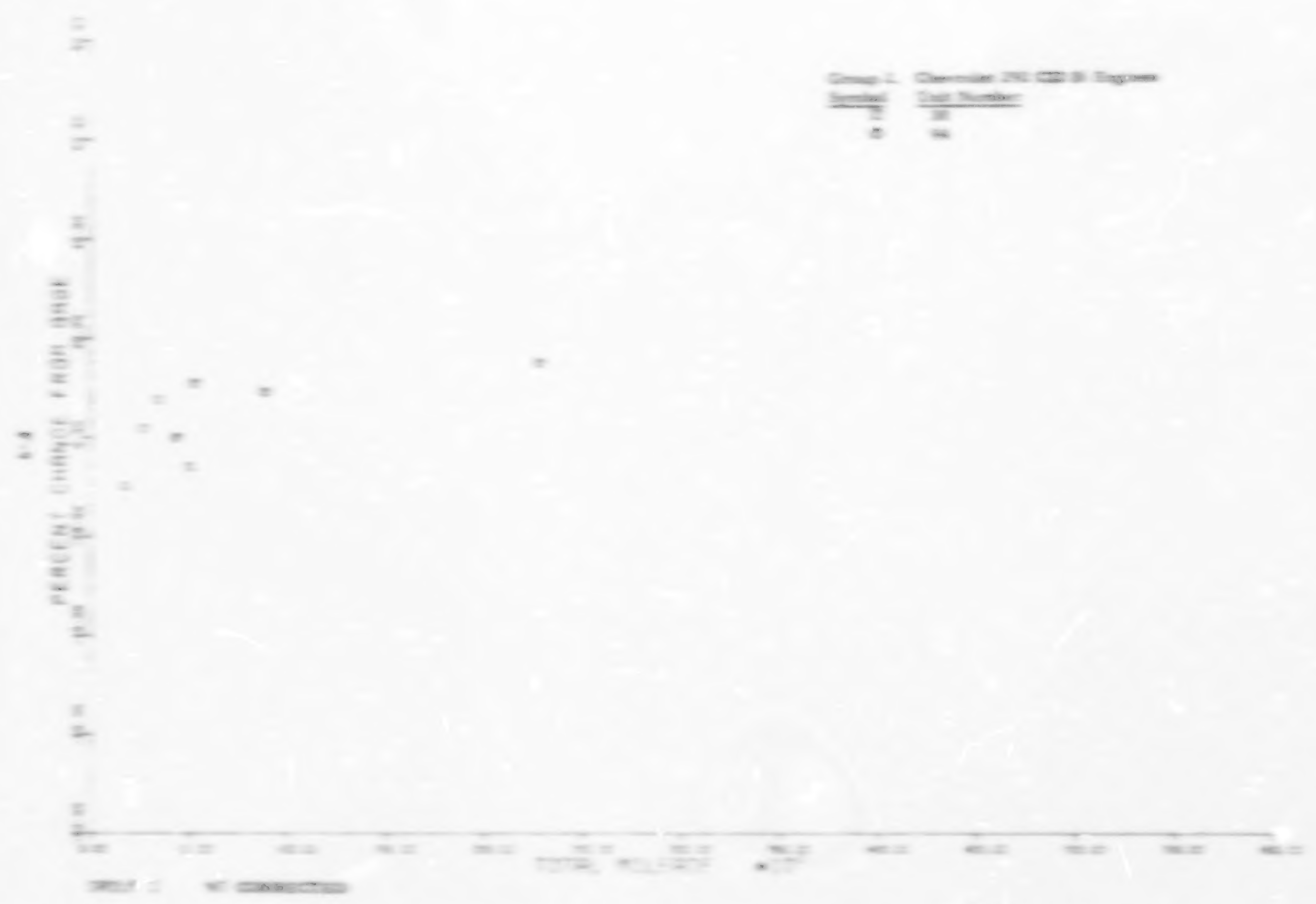

Group 1. Chevrolet 250 CID 6 Engines
Symbol Unit Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE

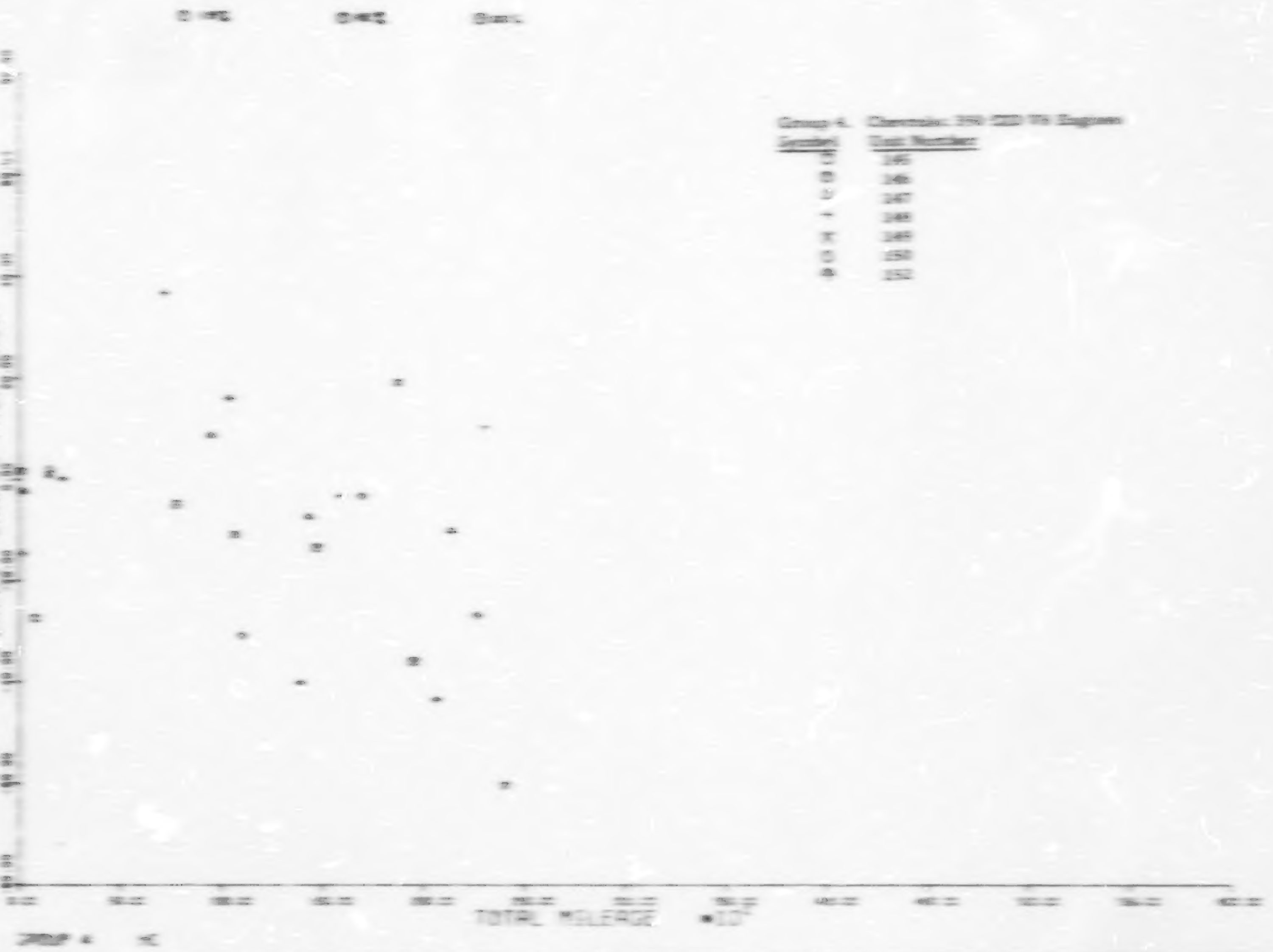

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Group 1.
Symbol
Unit Number

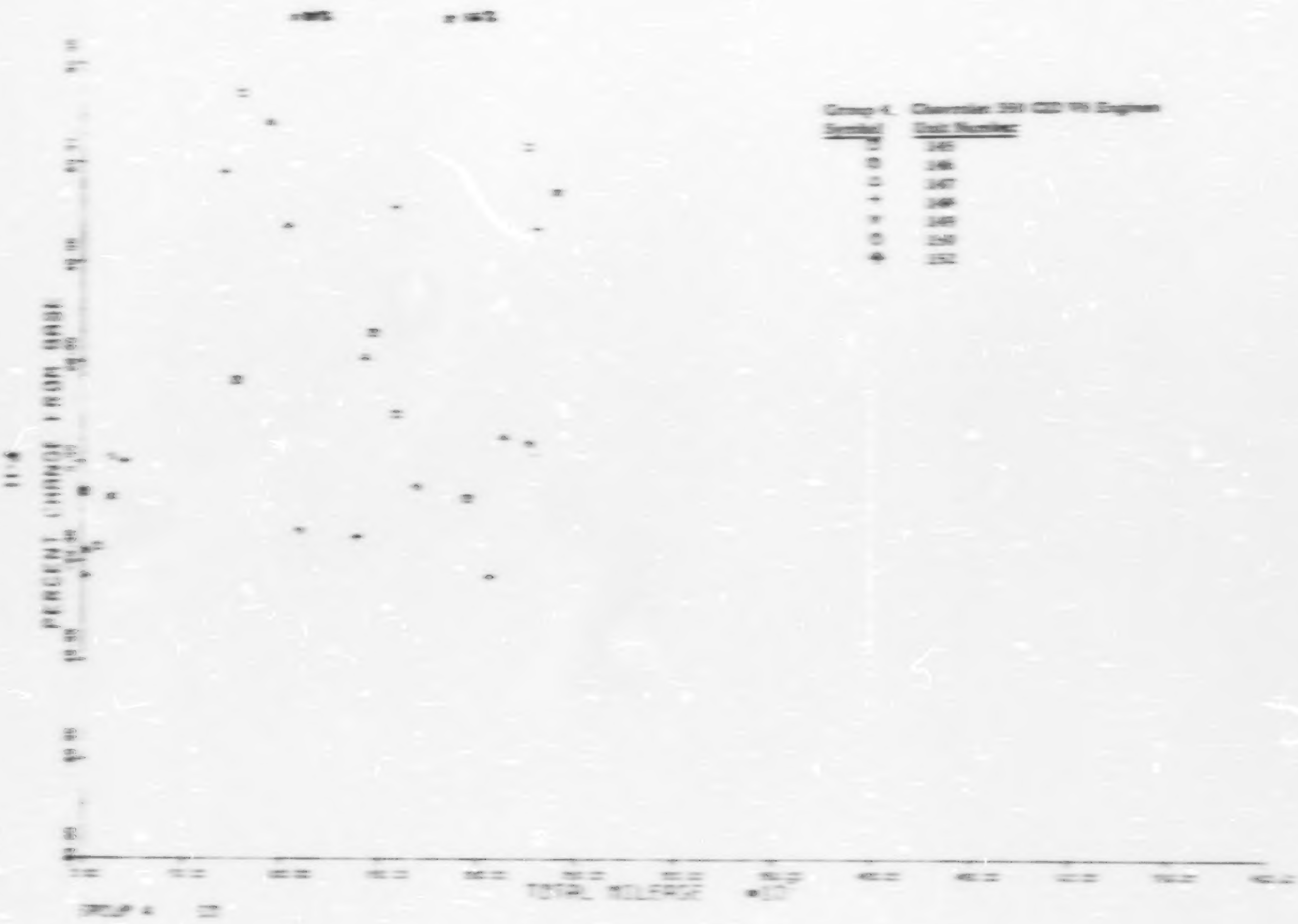

Group 1. Chevrolet 350 CID 8 Engines
Symbol
Car Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 1
HC

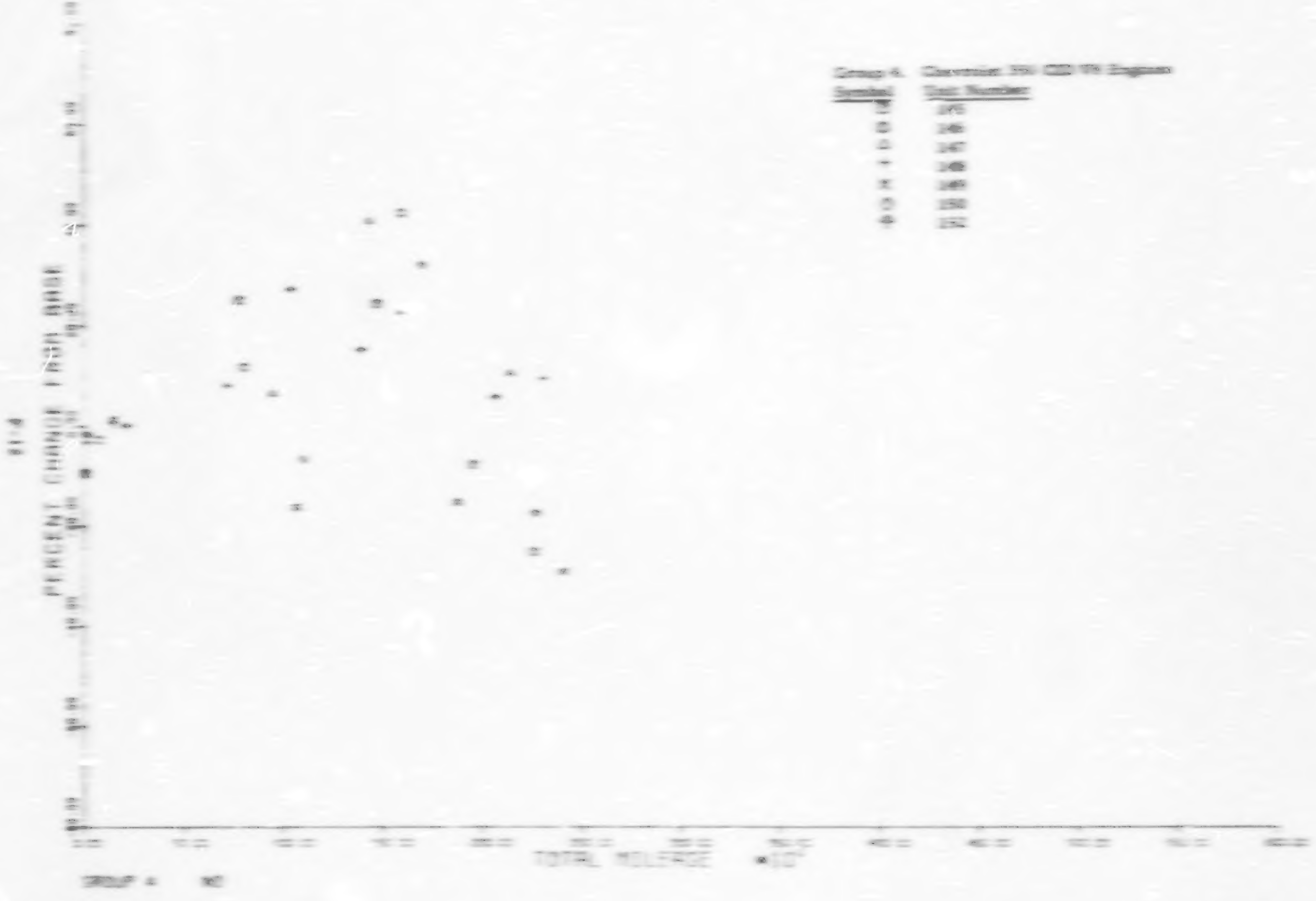

Group 1: Chevrolet 292 CID I6 Engines
Symbol
Unit Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 1

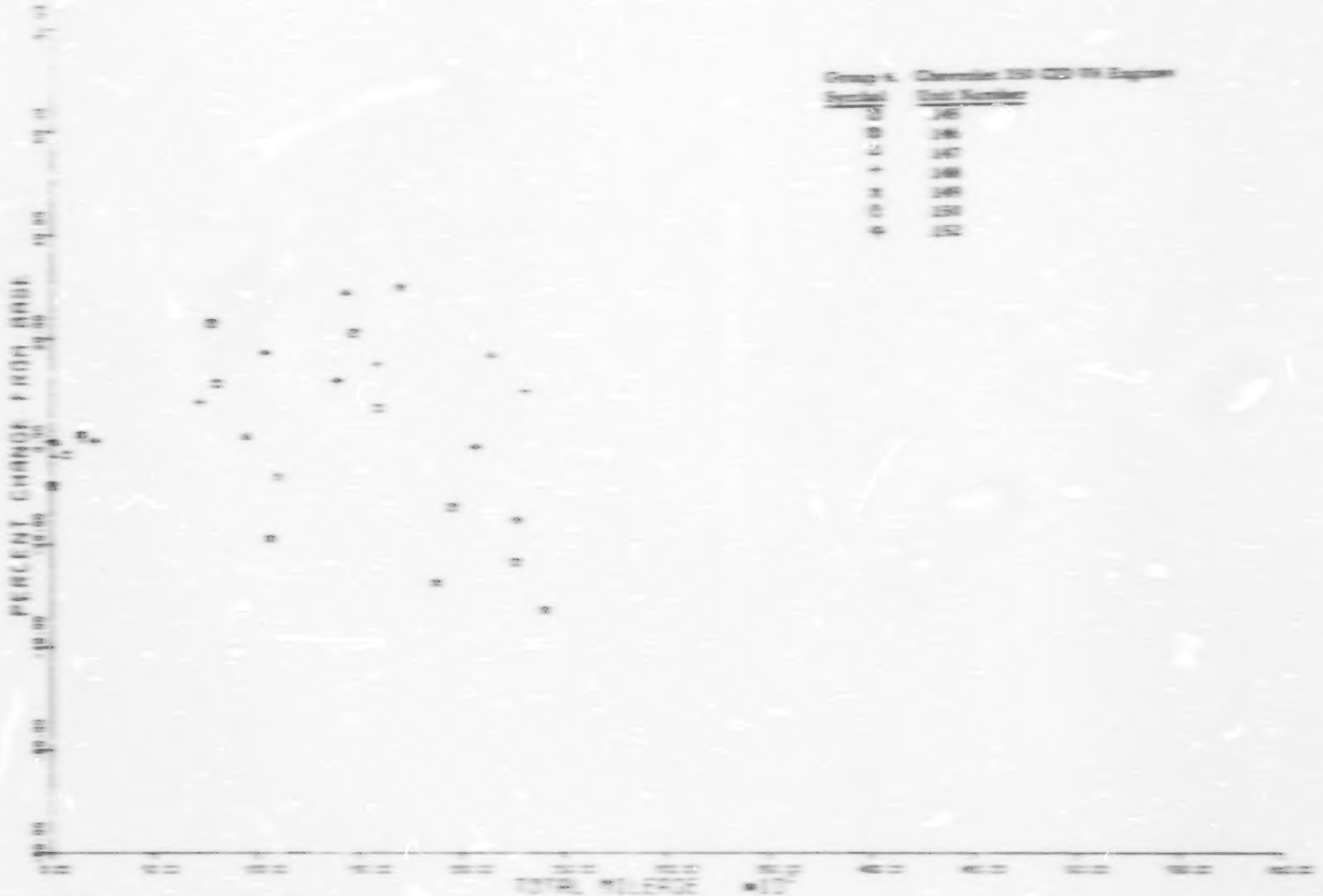
PERCENT CHANGE FROM BASE


Group 1. Chevrolet 292 CID Engines
Symbol
Unit Number
PERCENT CHANGE FROM BASE

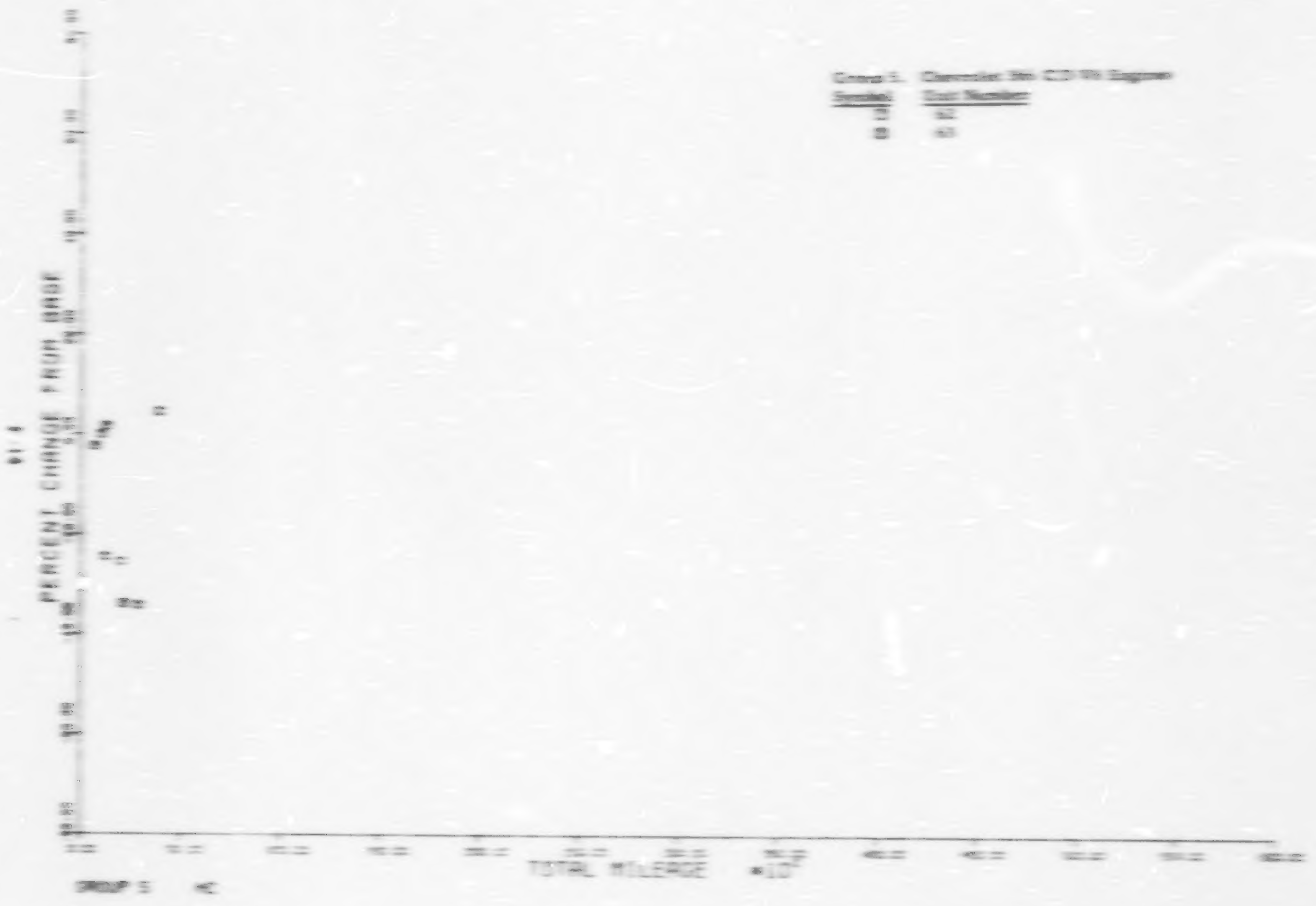

HC
CO
NOx
Group 4. Chevrolet 350 CID V8 Engines
Symbol
Unit Number
145
146
147
148
149
150
152
PERCENT CHANGE FROM BASE
TOTAL MILEAGE *10³

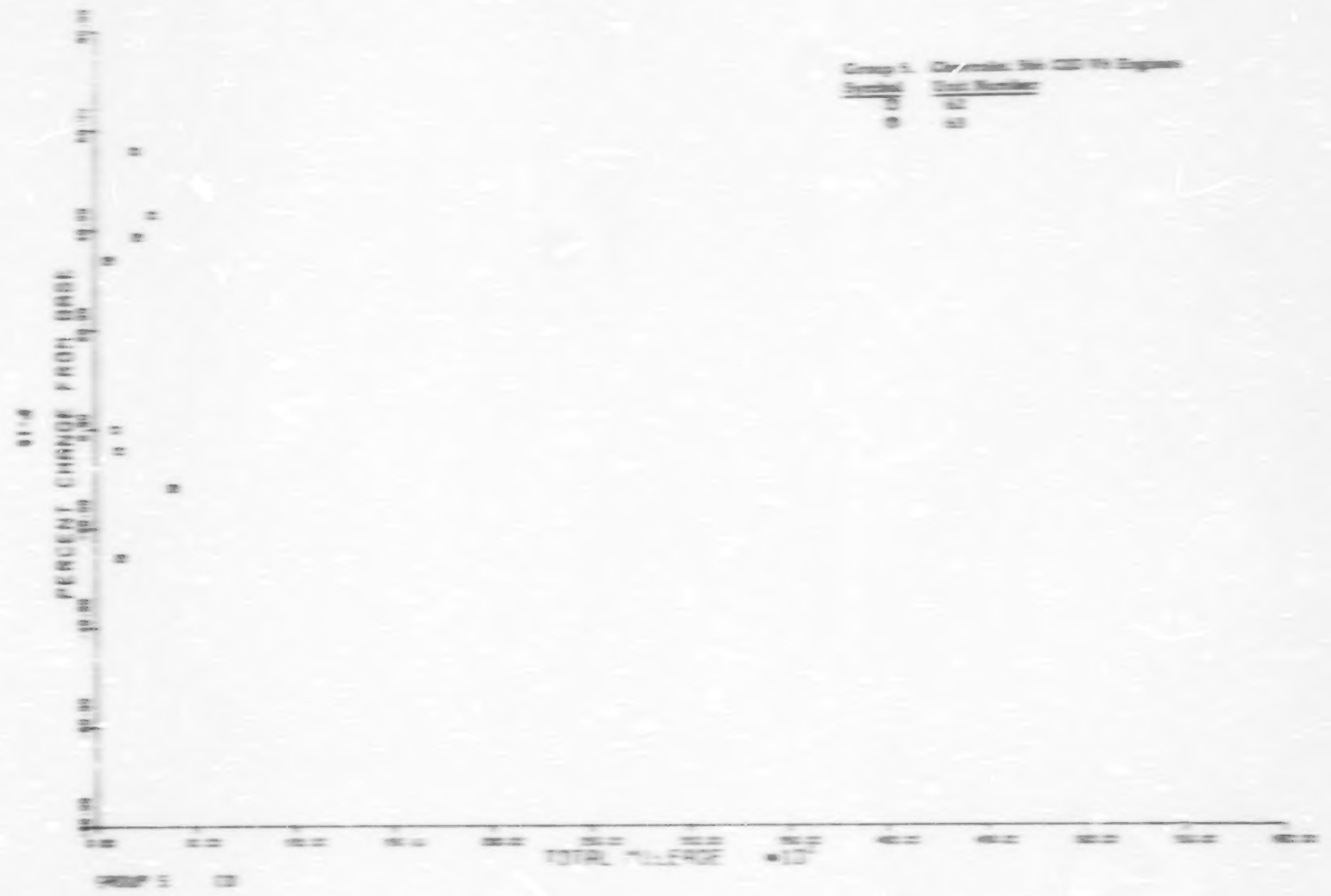

Group 4. Chevrolet 350 CID V8 Engines
Symbol
Unit Number
145
146
147
148
149
150
152
PERCENT CHANGE FROM BASE
TOTAL MILEAGE

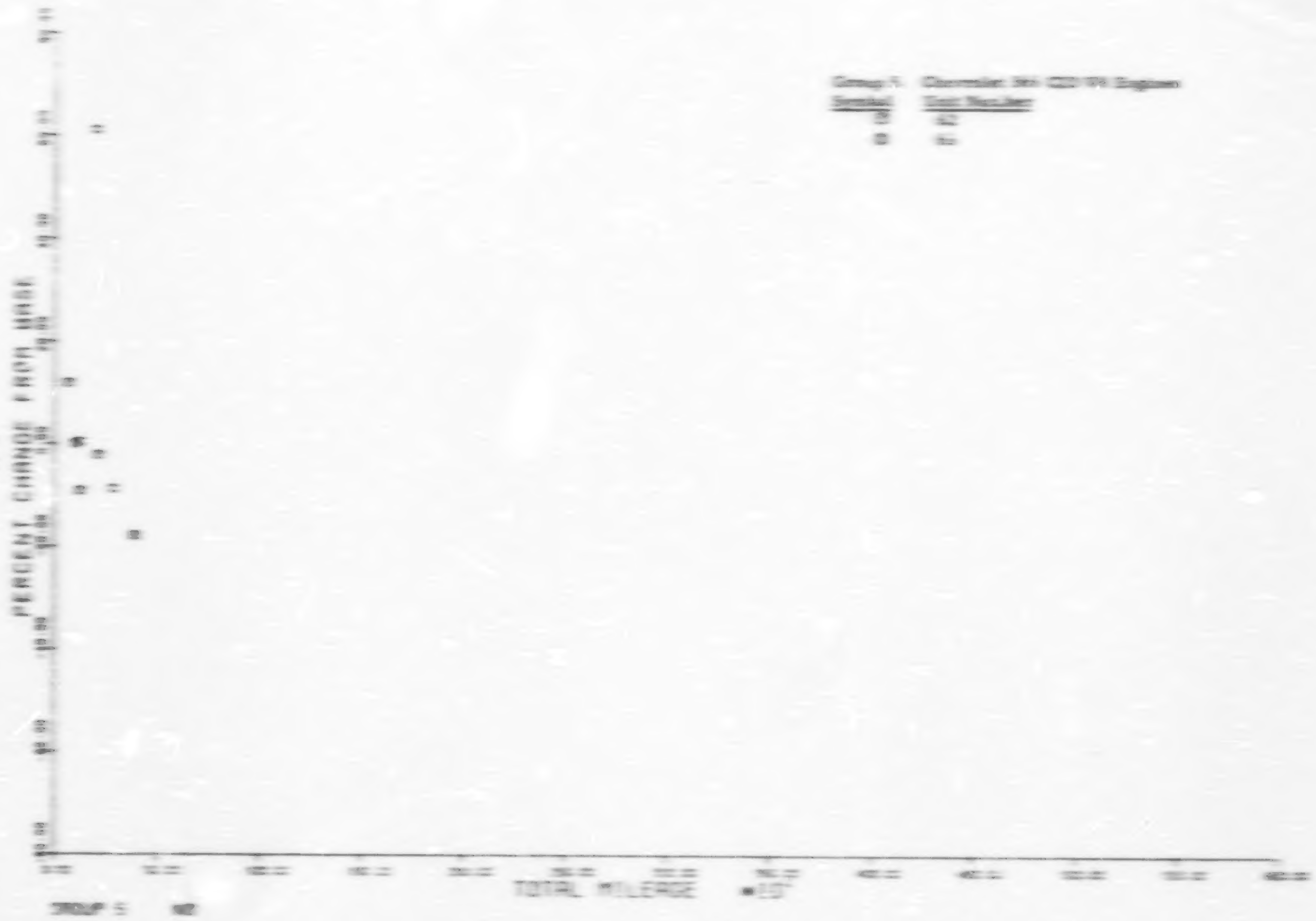

Group 4. Chevrolet 350 CID V8 Engines
Symbol
Unit Number
145
146
147
148
149
150
152
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 4

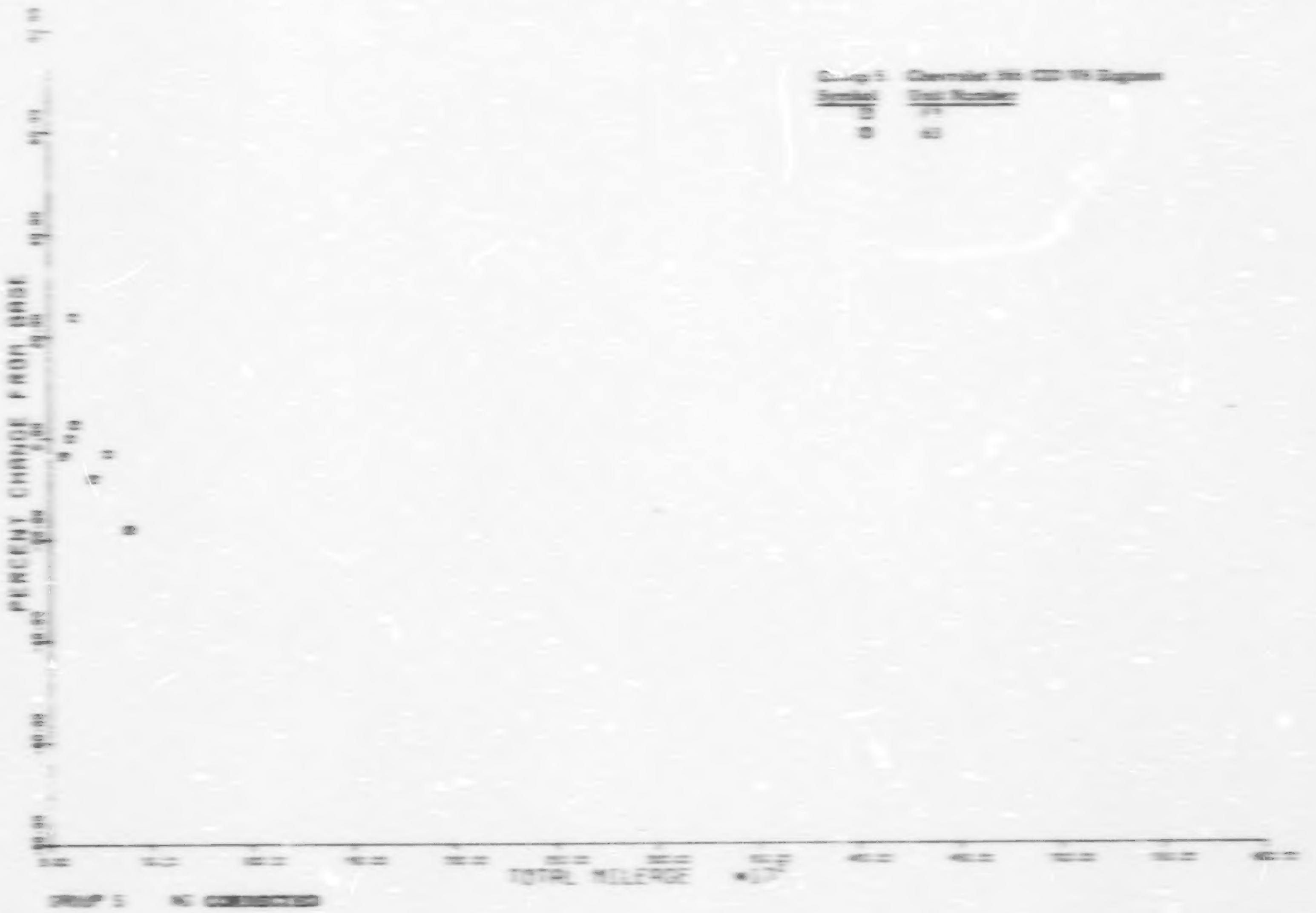


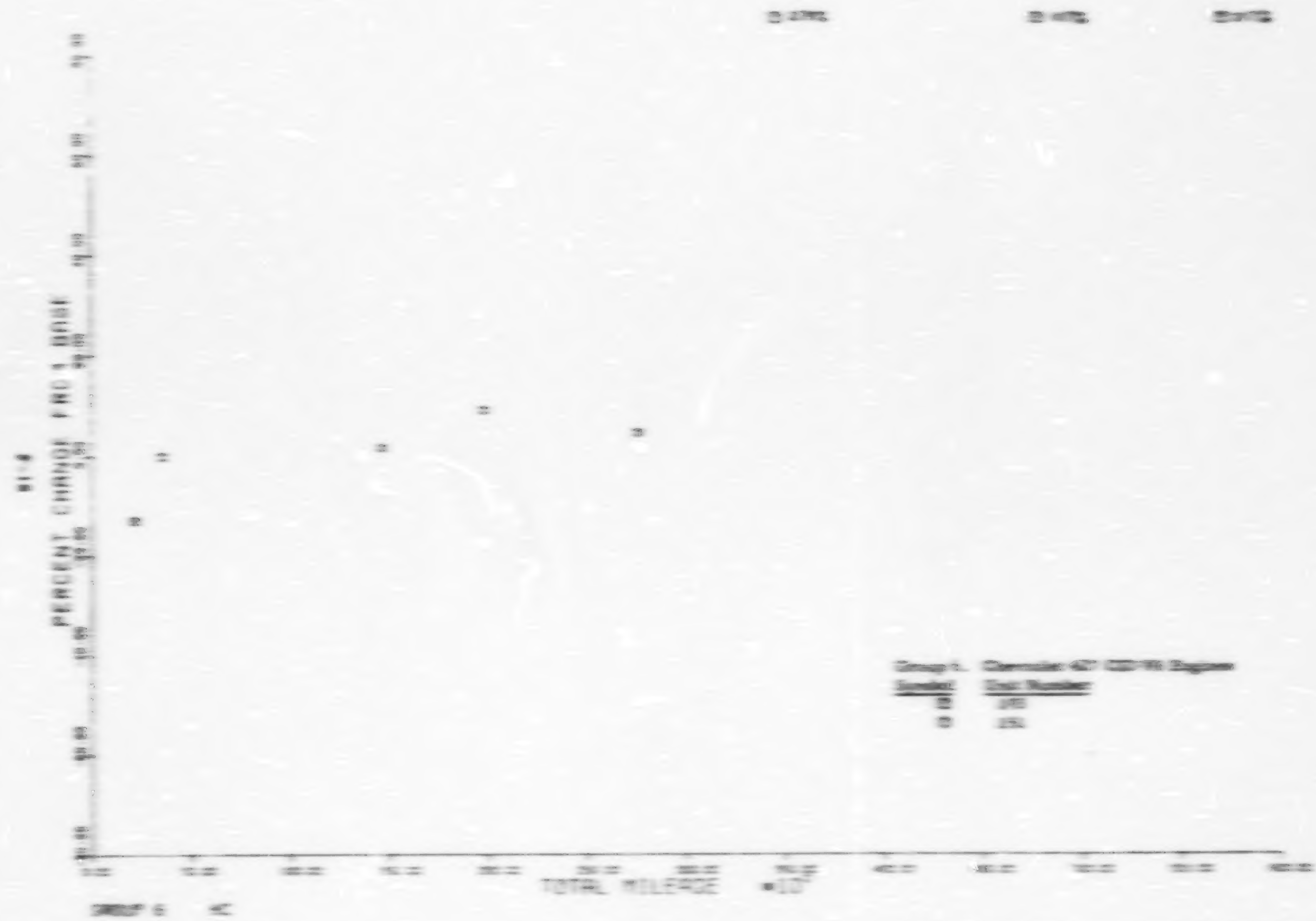
GROUP 4 NC CORRECTED

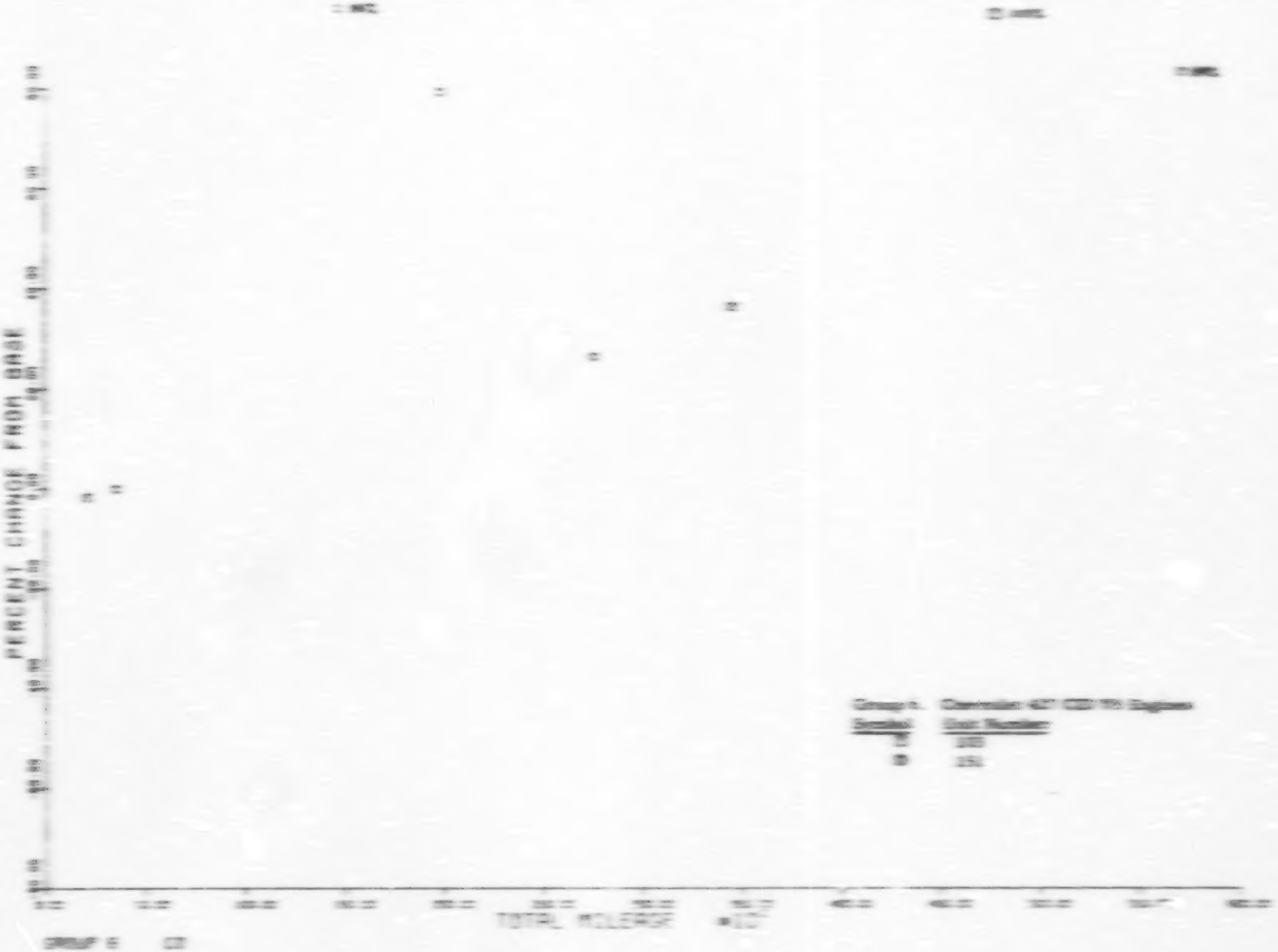

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 5
HC

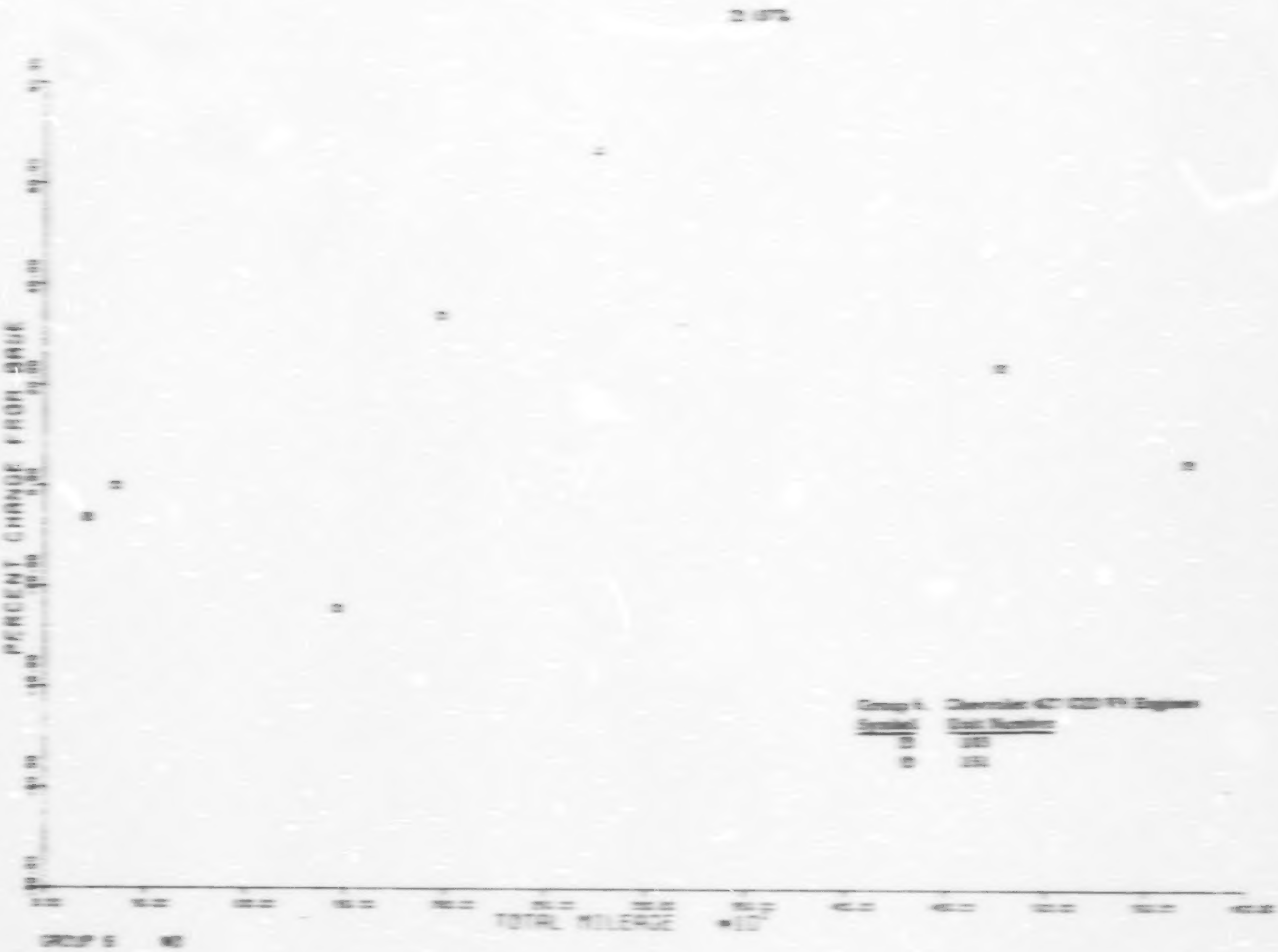

PERCENT CHANGE FROM BASE
TOTAL MILEAGE *10³

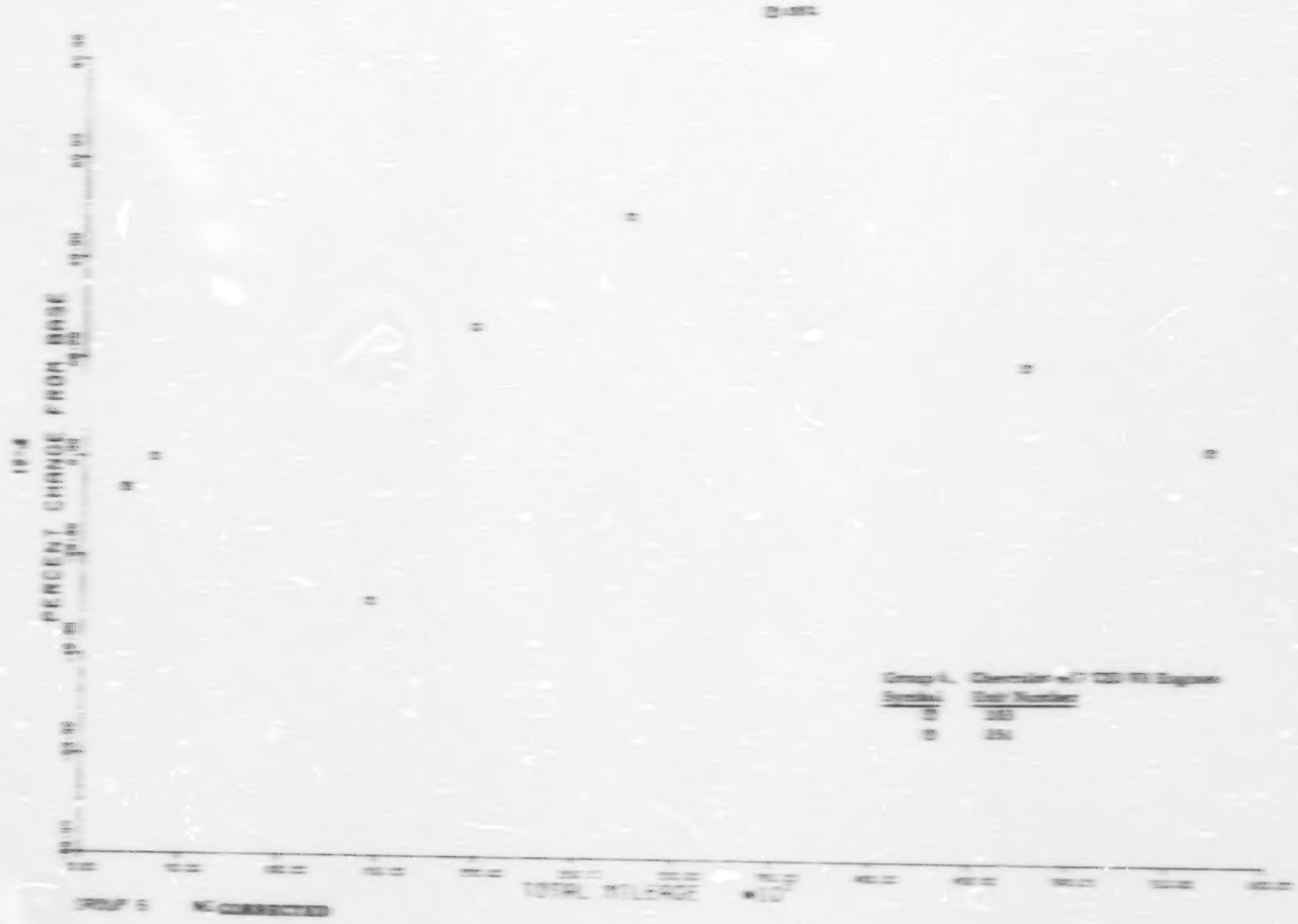

Group 5: Chevrolet 350 CID V8 Engines
Symbol
Unit Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 5


PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Unit Number

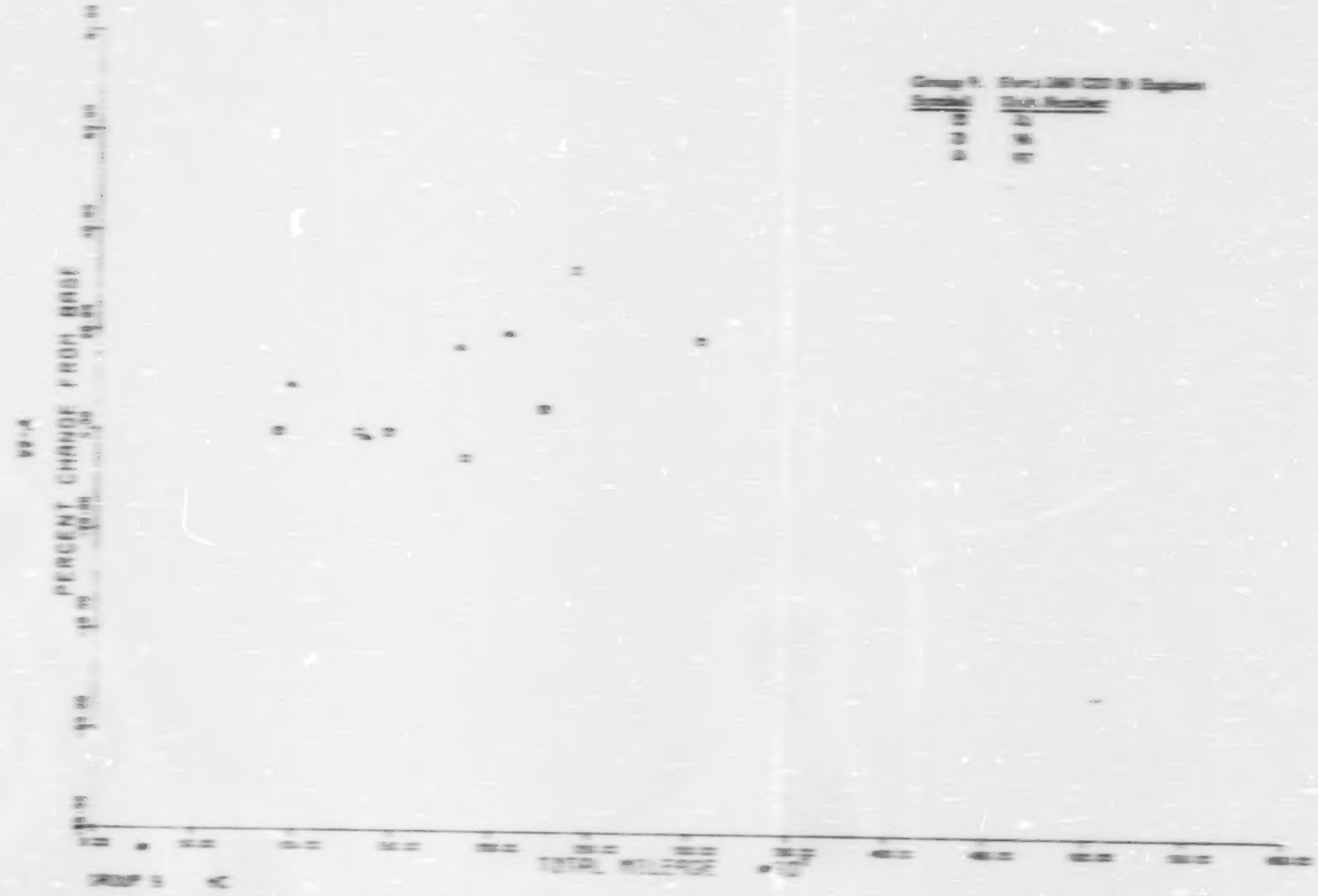

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Car Number

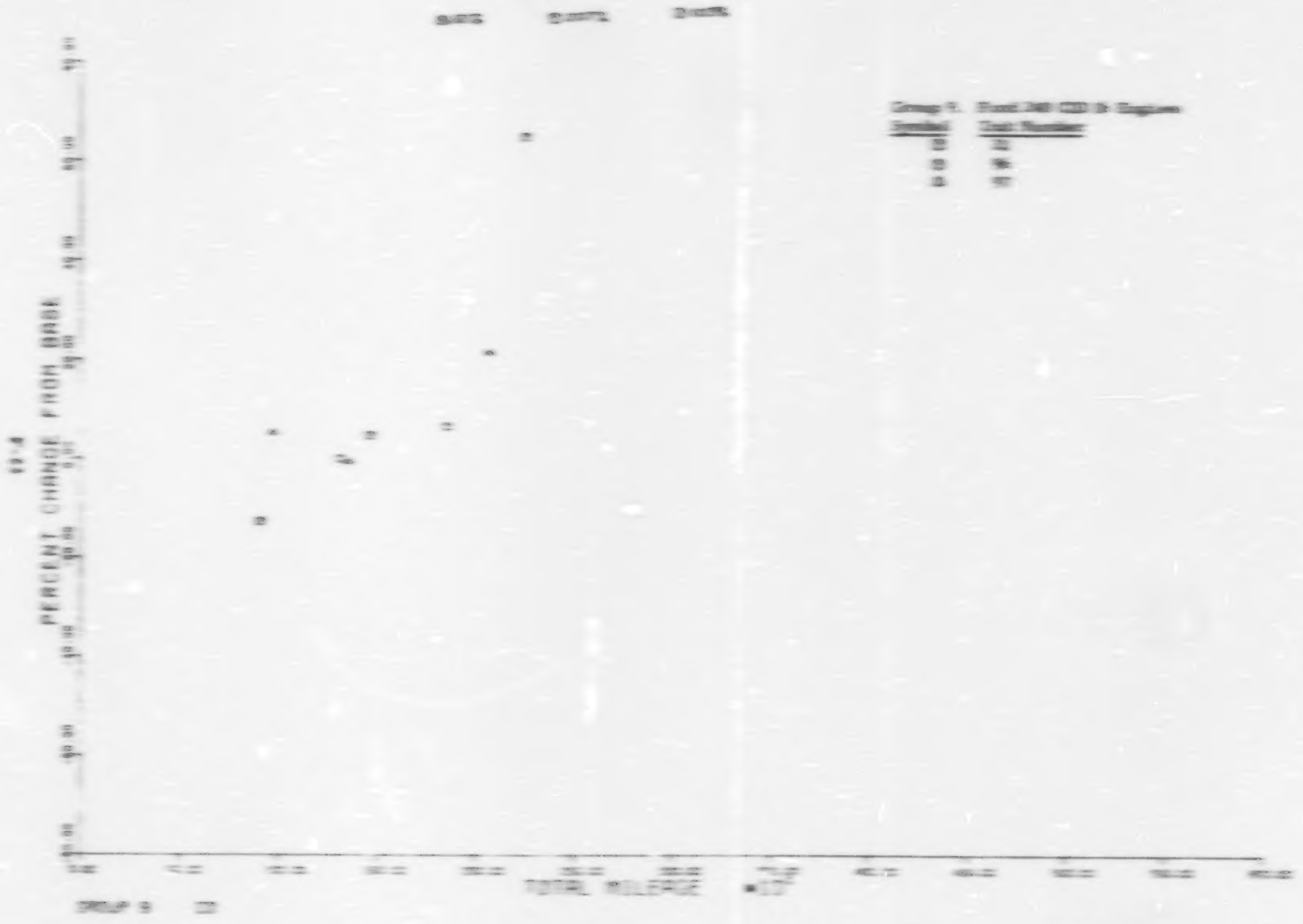

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP

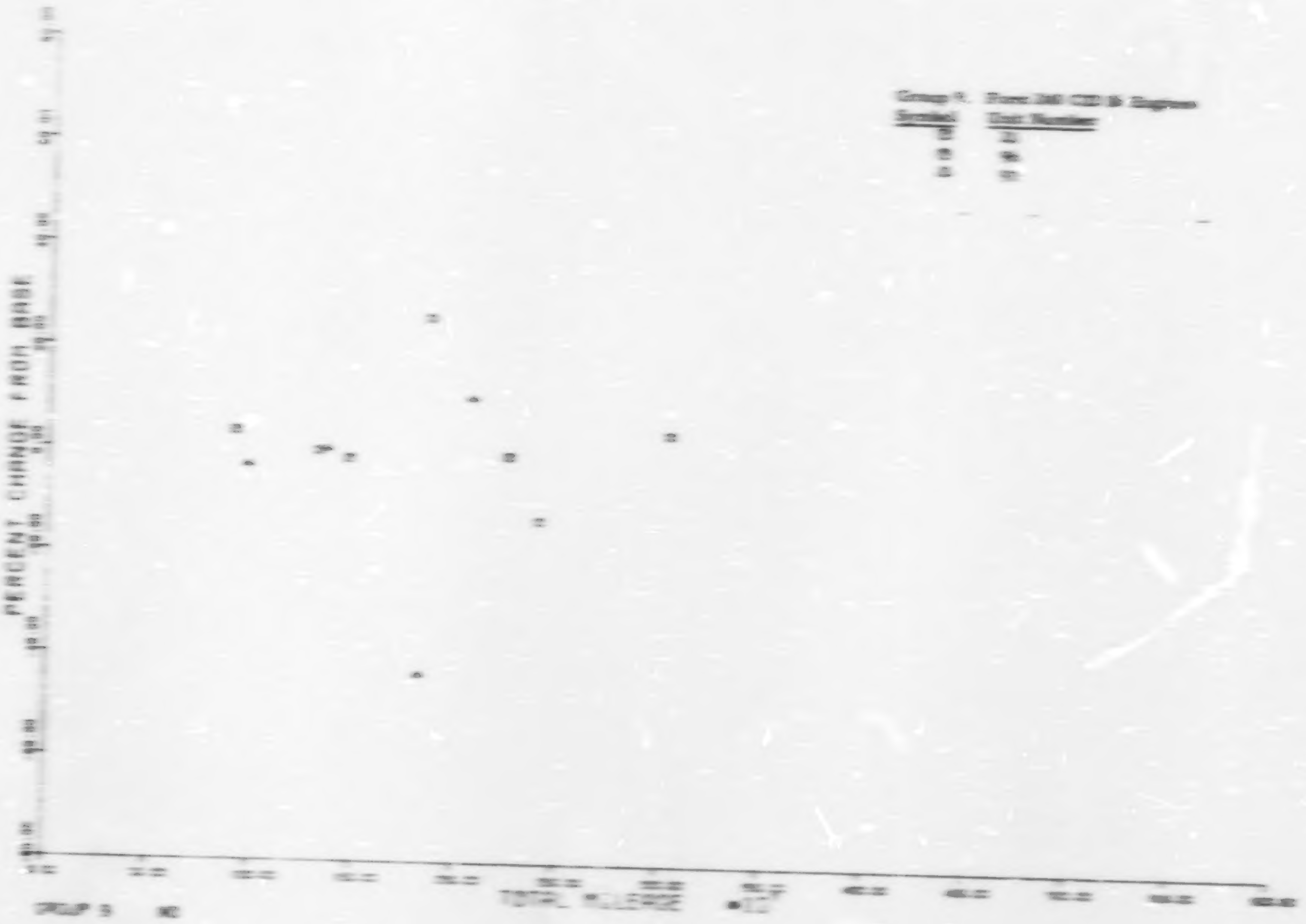

PERCENT CHANGE FROM BASE
Symbol
Unit Number
TOTAL MILEAGE

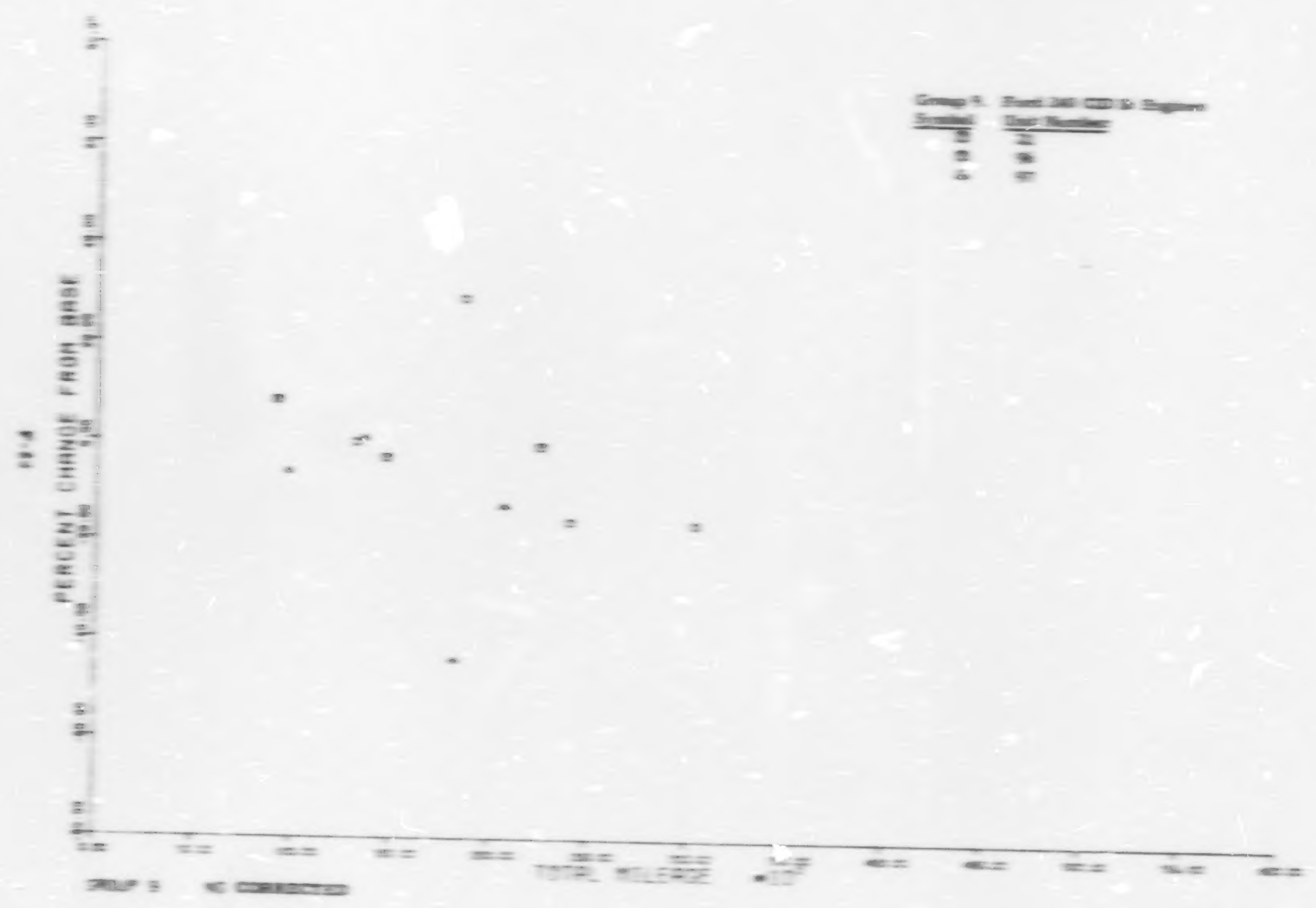


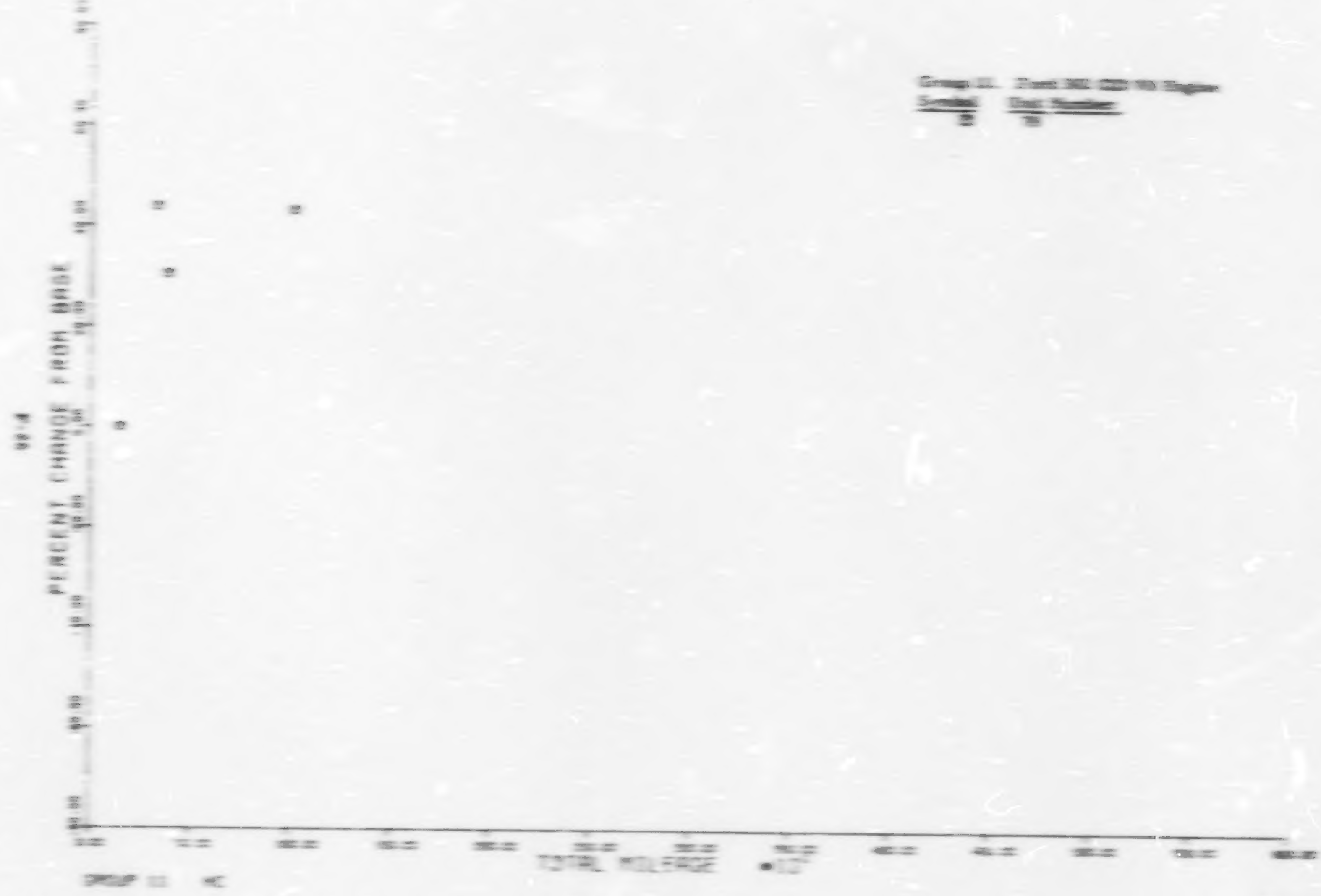
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Car Number

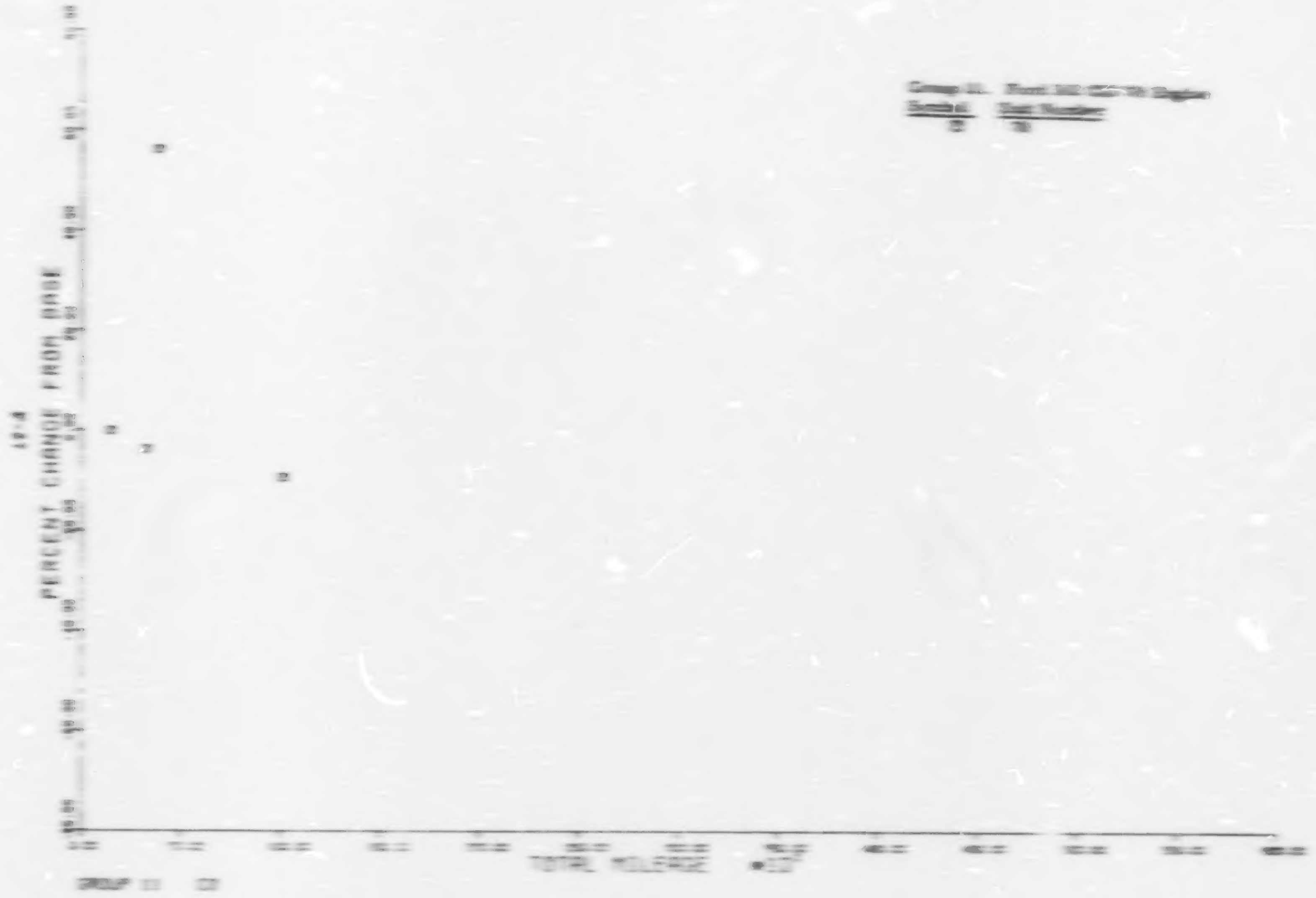

PERCENT CHANGE FROM BASE
TOTAL MILEAGE

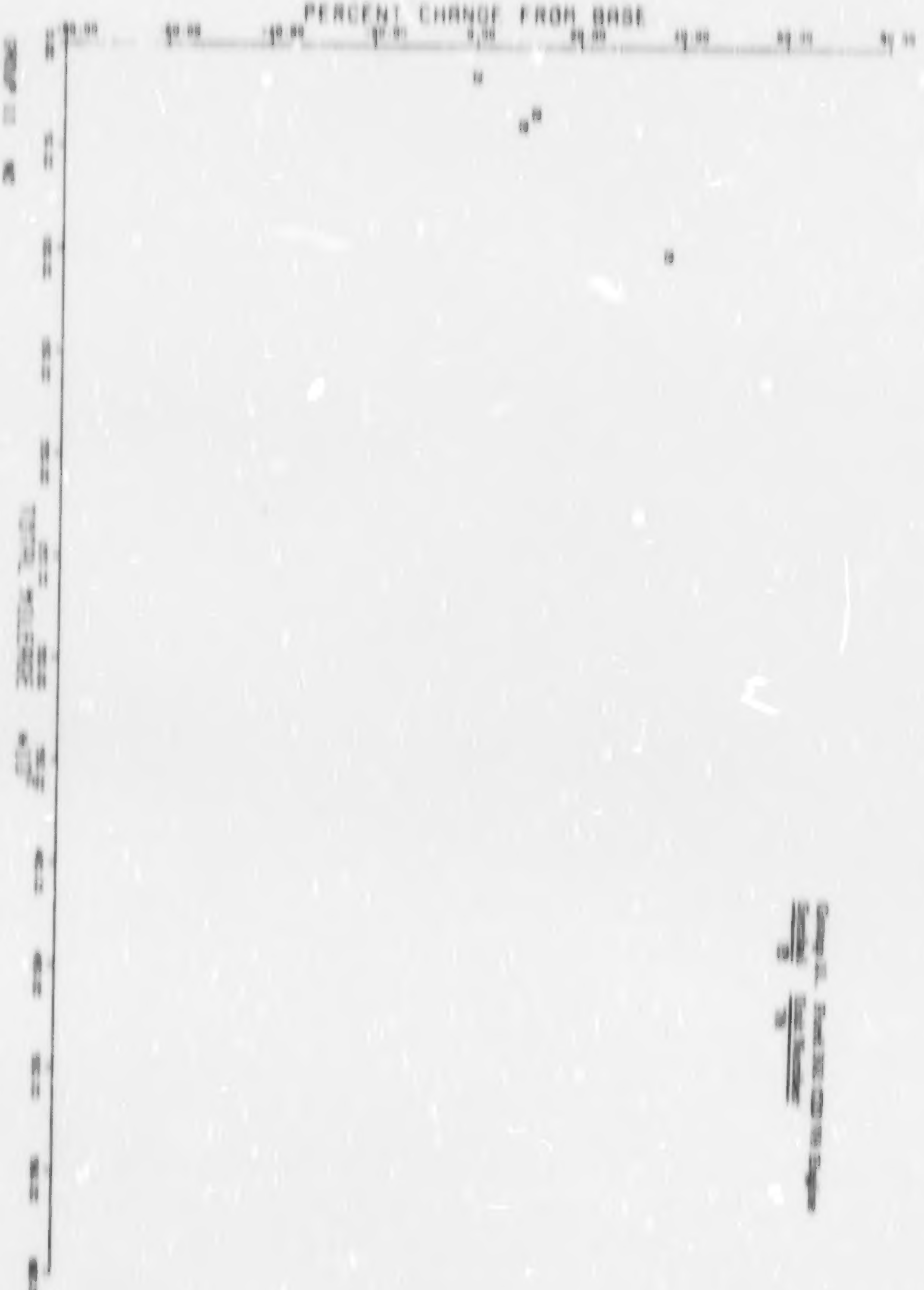

PERCENT CHANGE FROM BASE
TOTAL MILEAGE

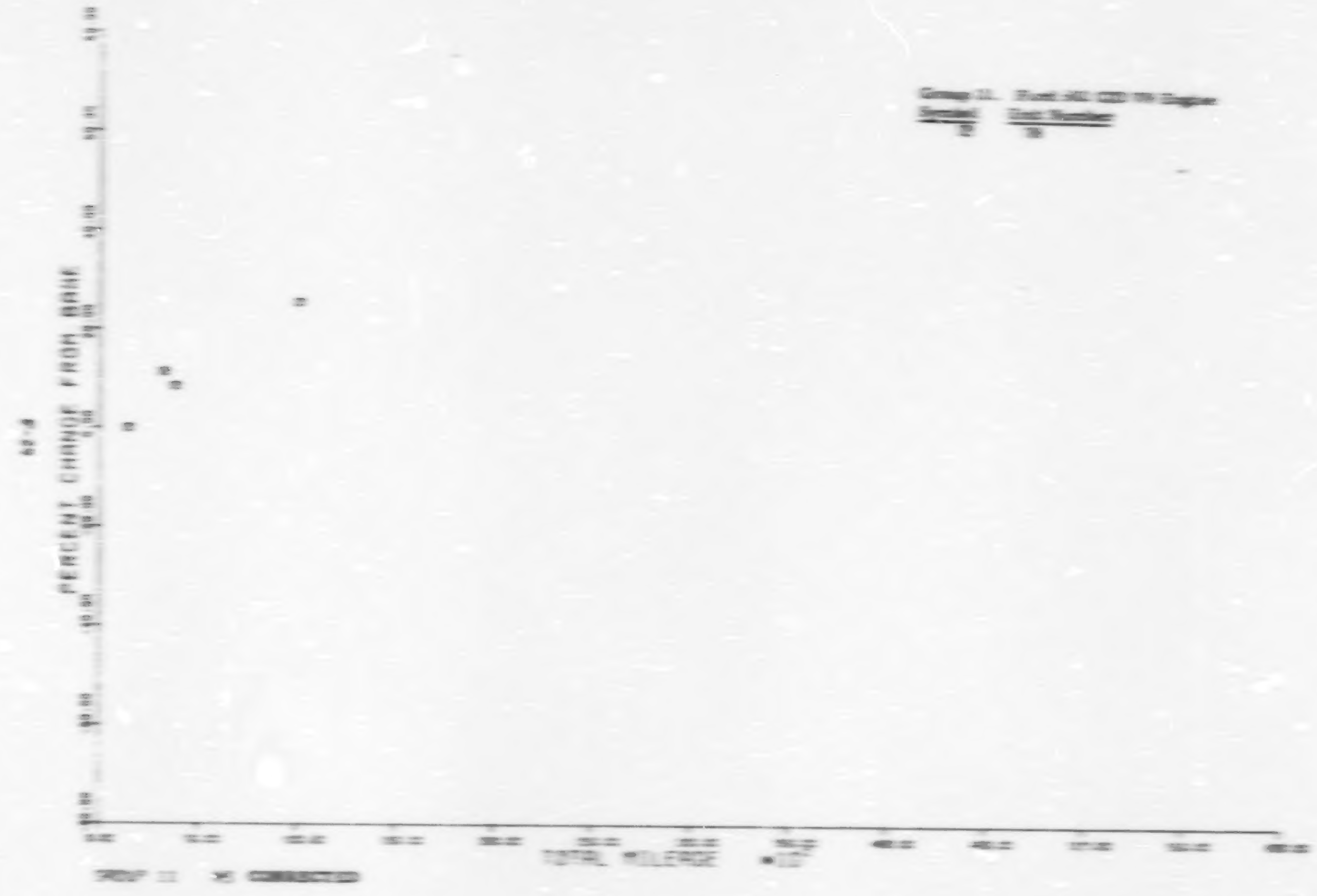

PERCENT CHANGE FROM BASE
TOTAL MILEAGE

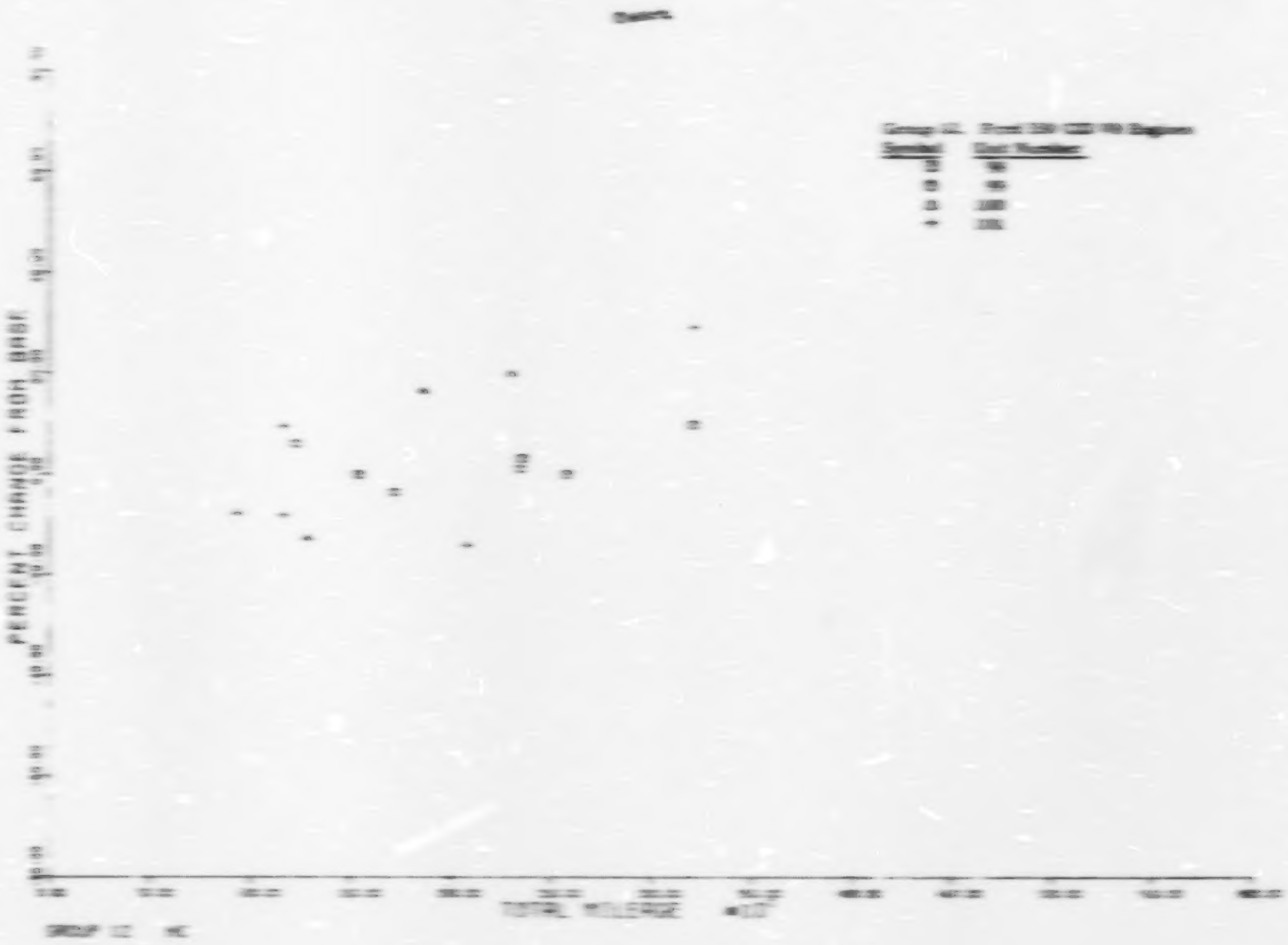

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Unit Number

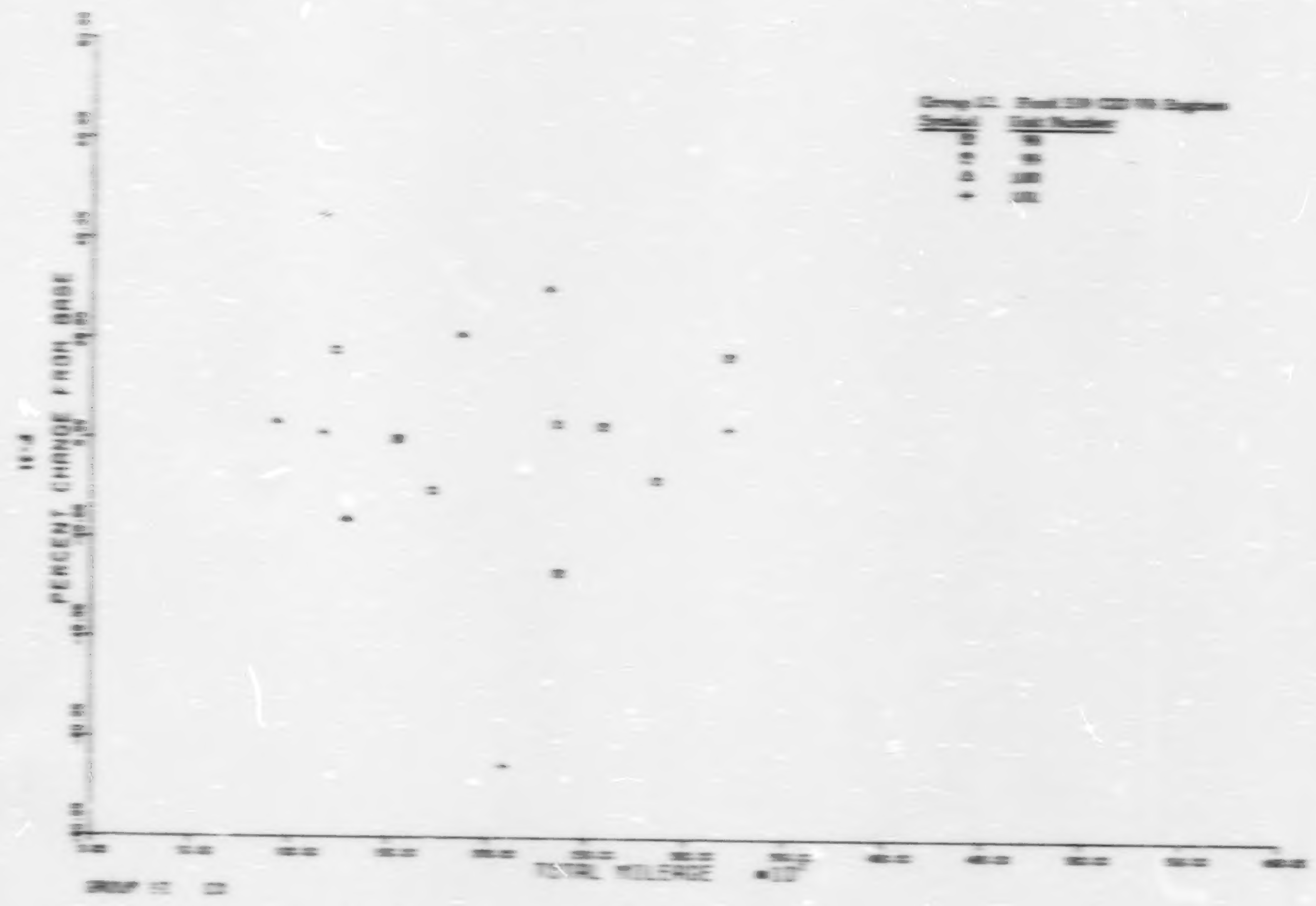

PERCENT CHANGE FROM BASE
TOTAL MILEAGE


PERCENT CHANGE FROM BASE
TOTAL MILEAGE

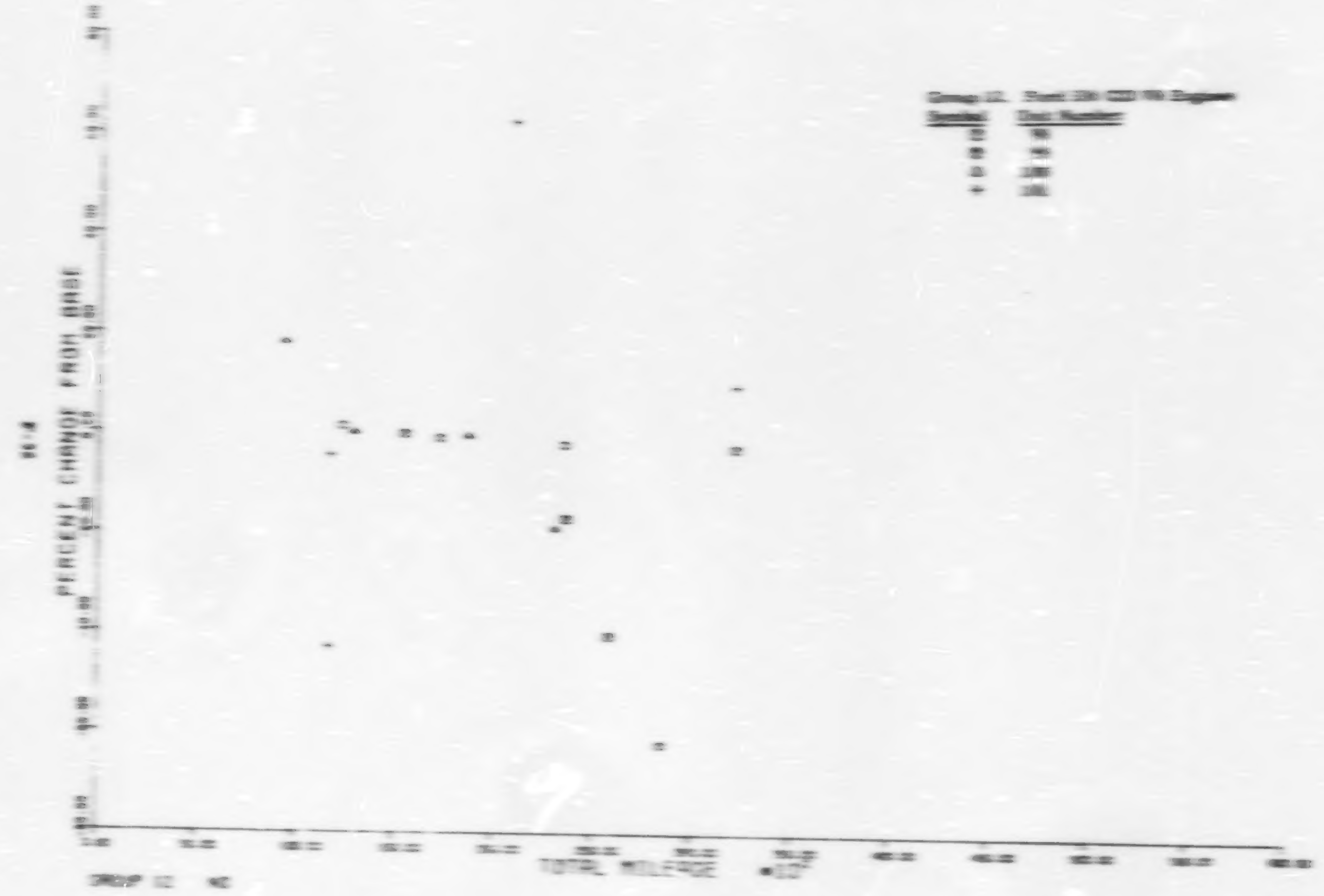

PERCENT CHANGE FROM BASE
TOTAL MILEAGE

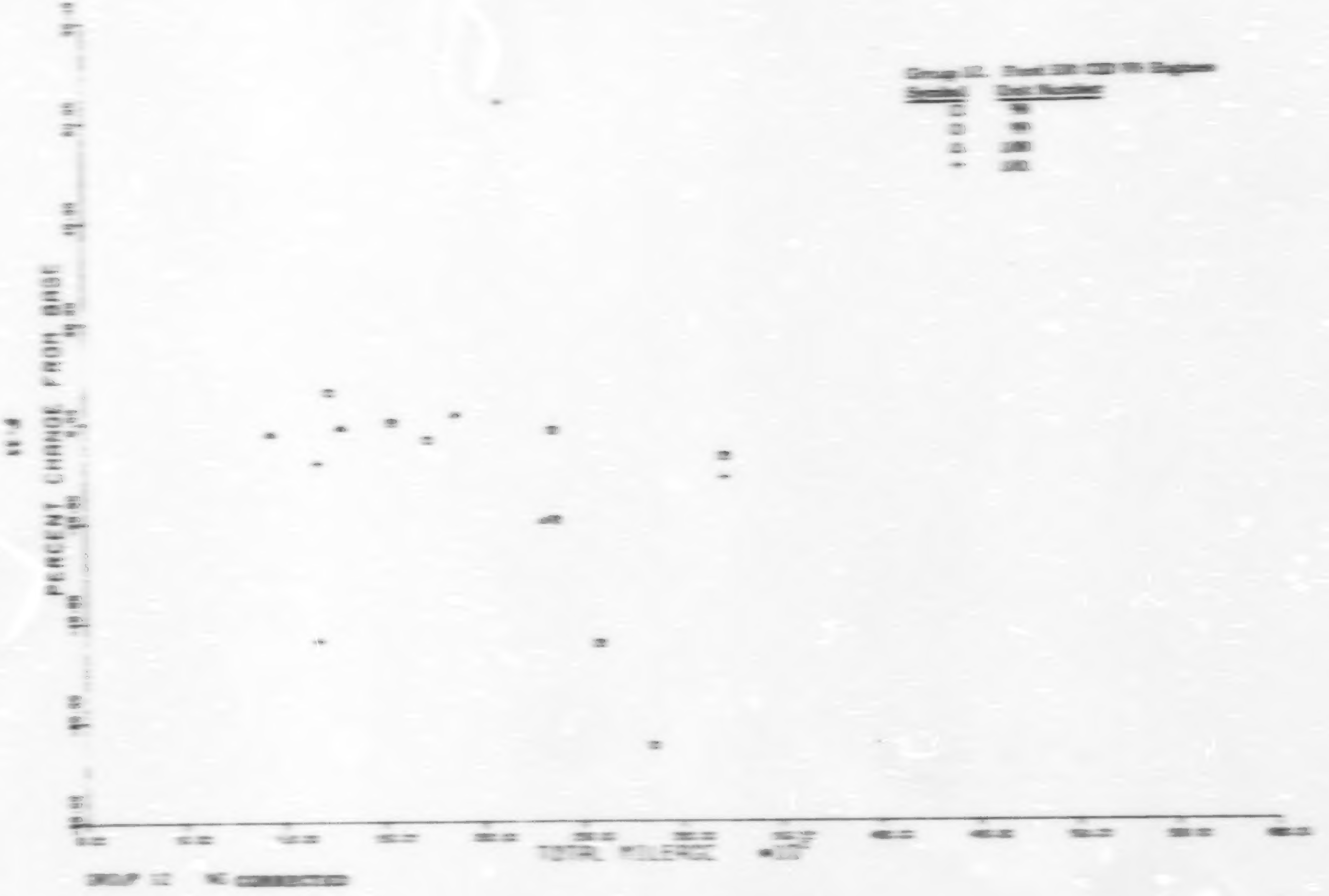

PERCENT CHANGE FROM BASE
TOTAL MILEAGE

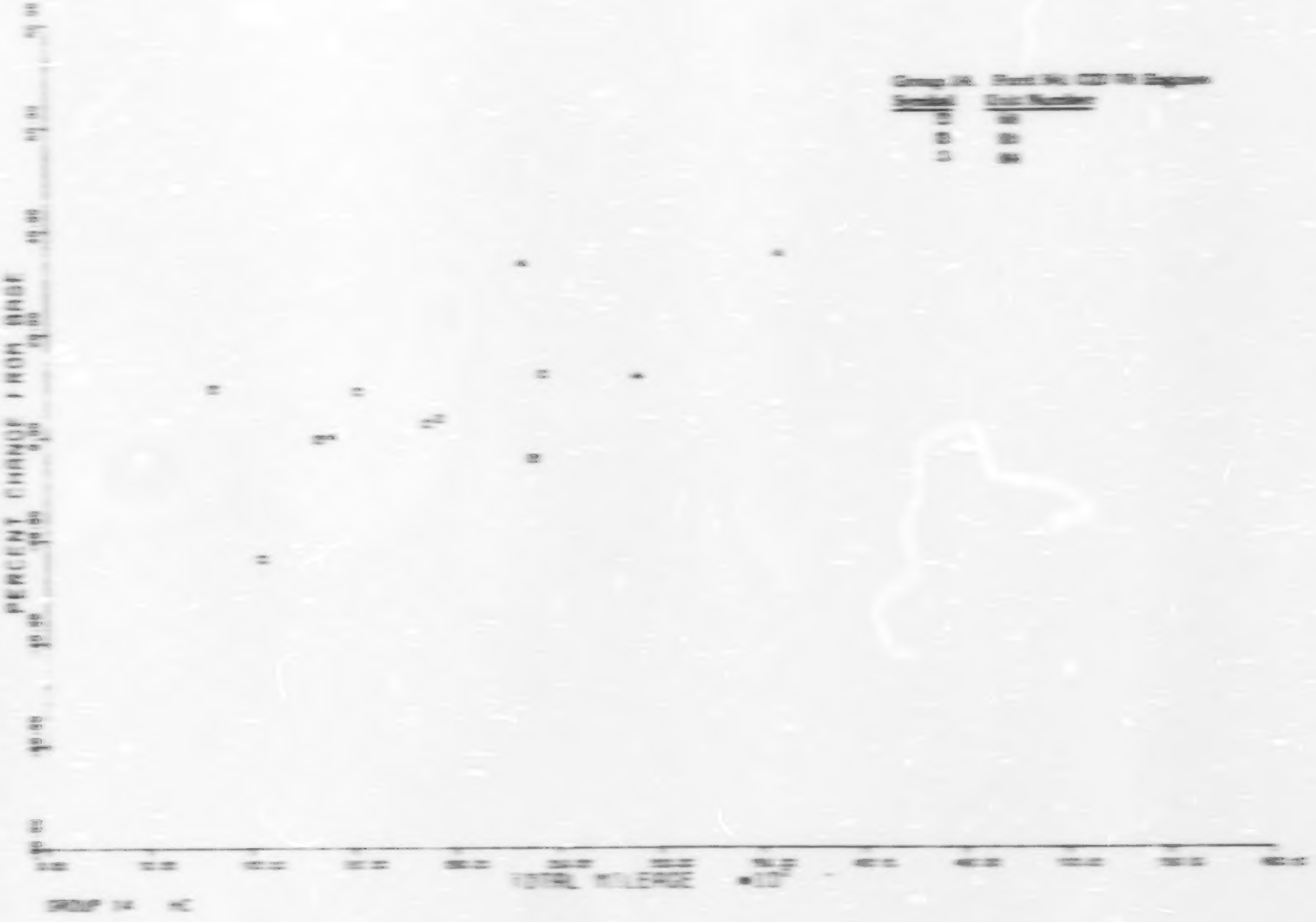

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Car Number

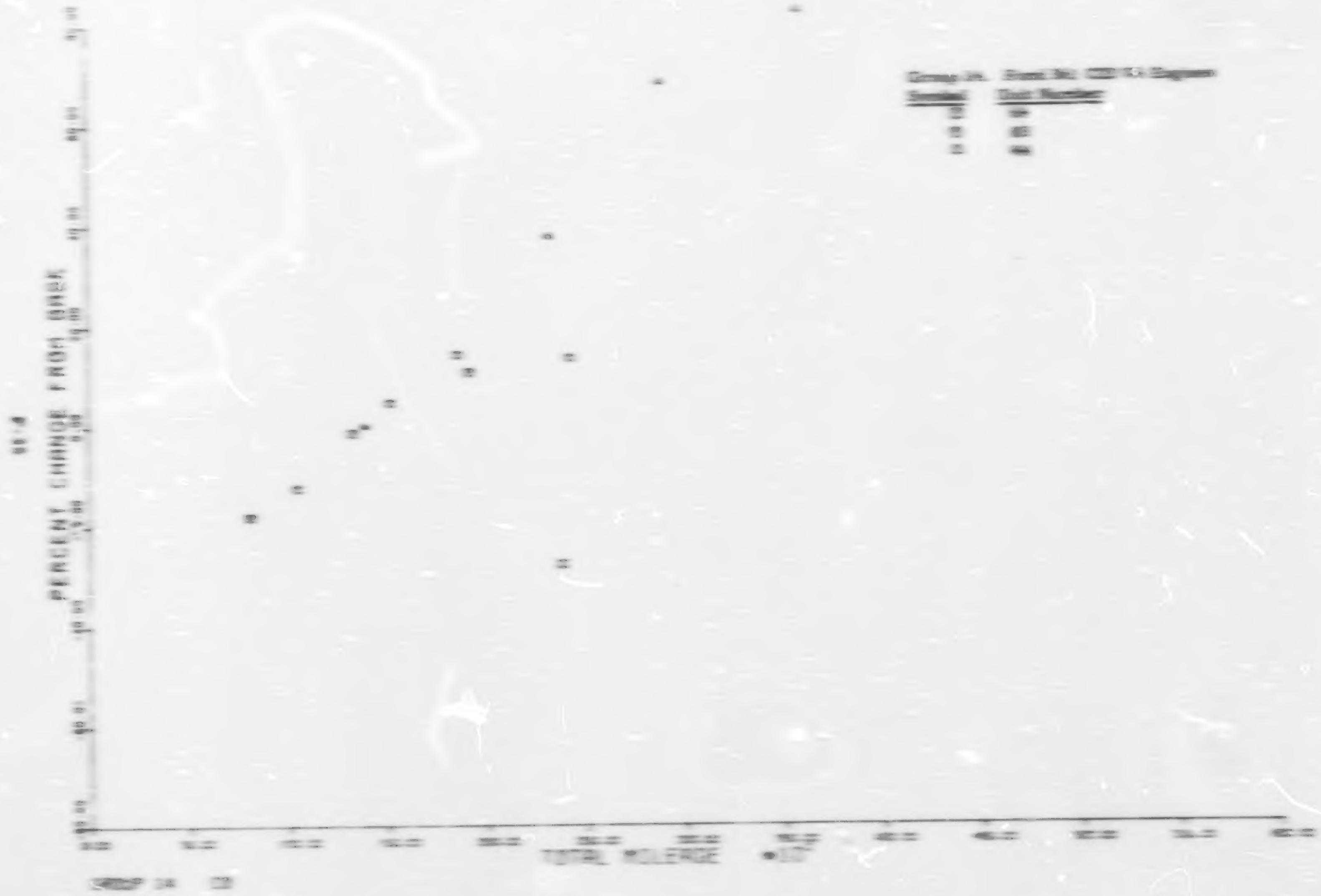

PERCENT CHANGE FROM BASE
TOTAL MILEAGE ×10³
GROUP 11
Symbol
Car Number

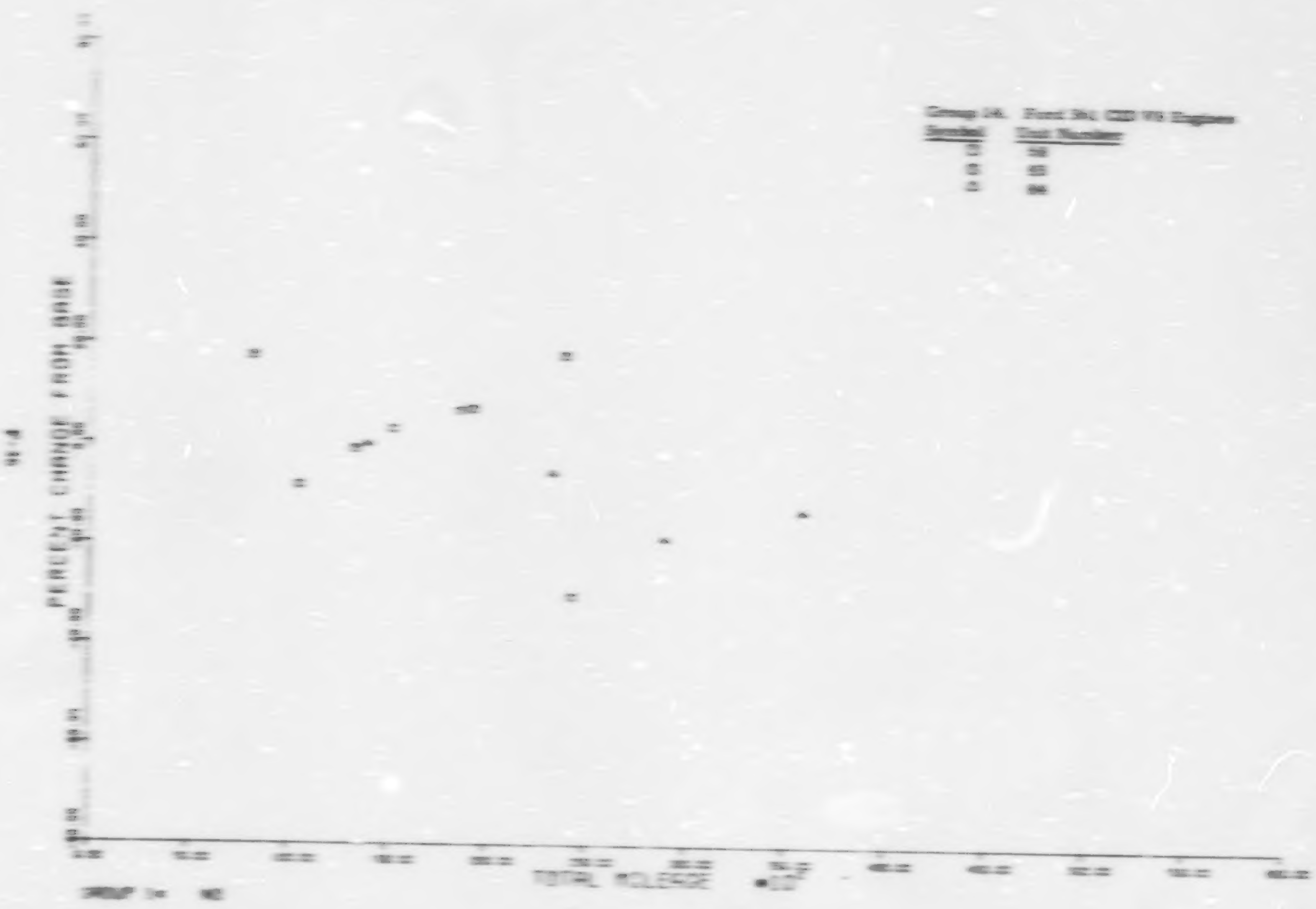
11-4

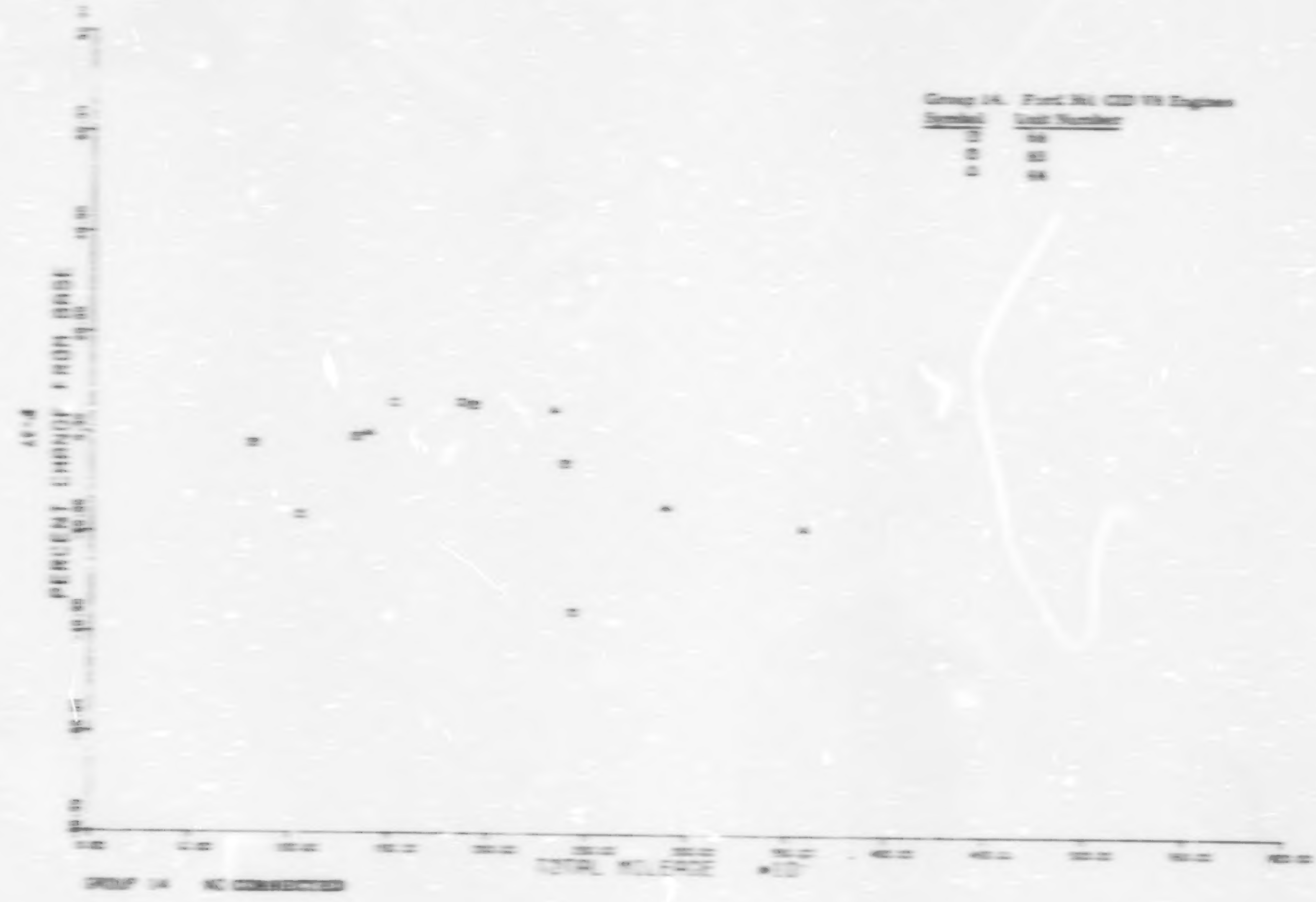

PERCENT CHANGE FROM BASE
TOTAL MILEAGE

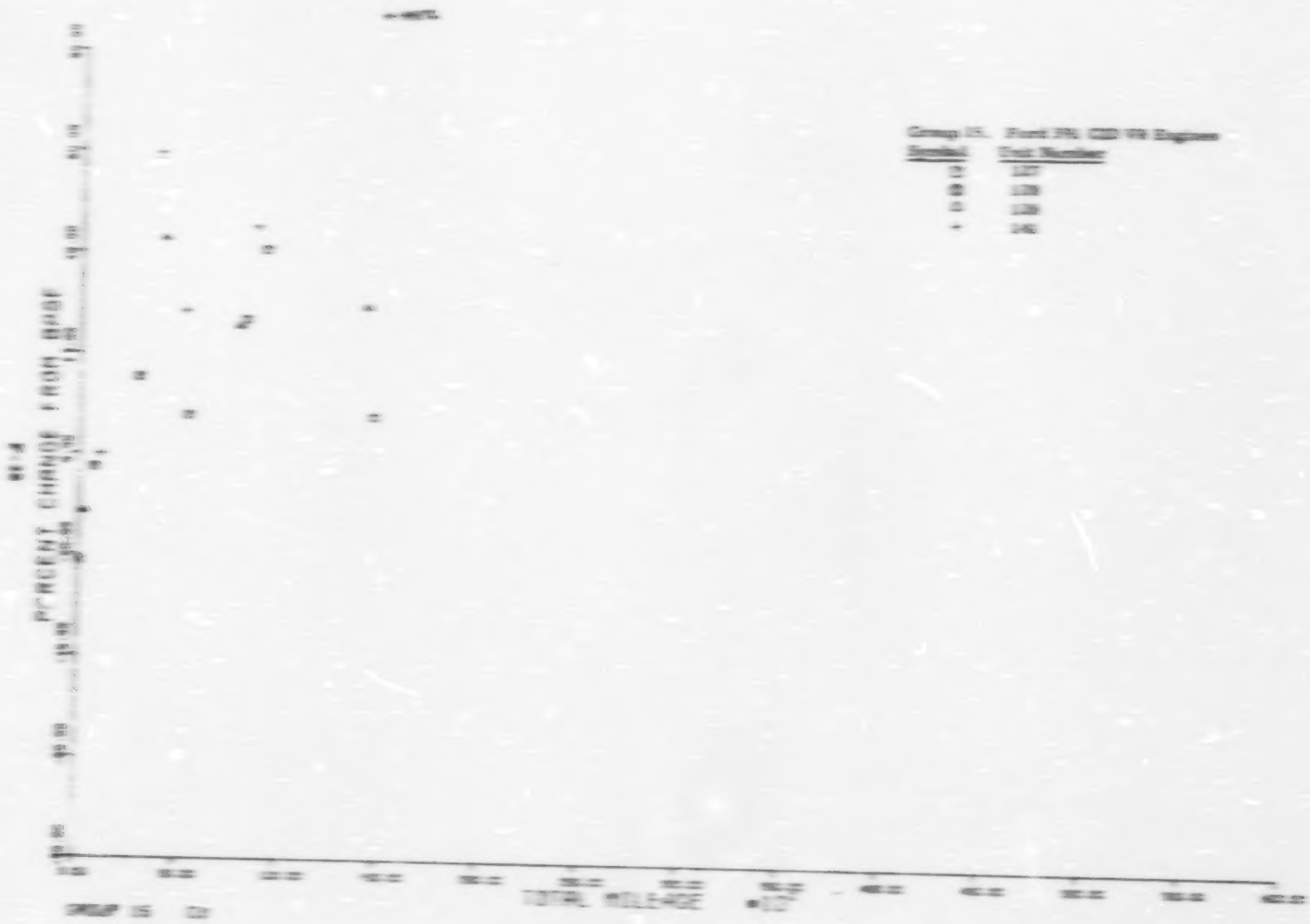

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Car Number

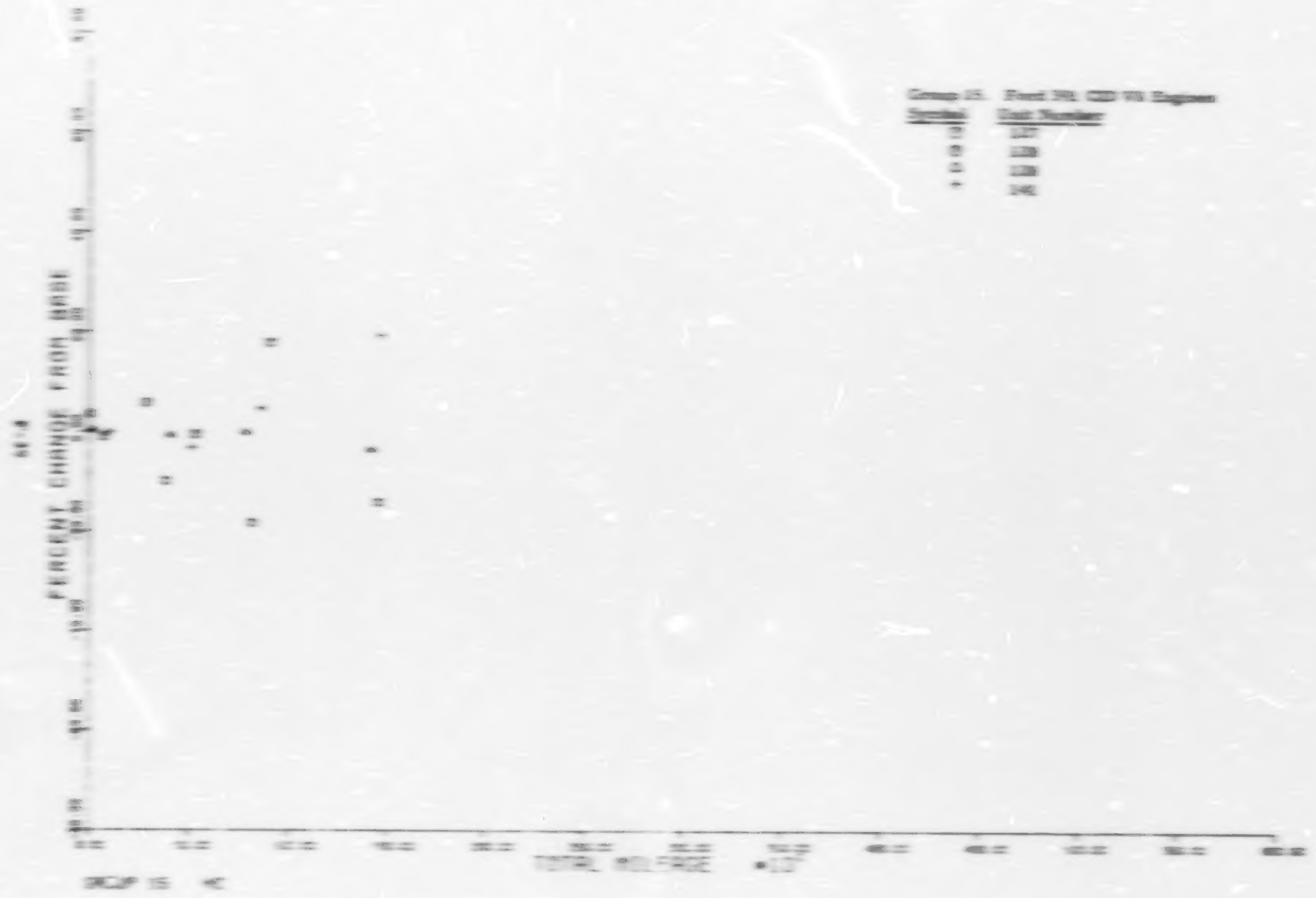
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 14 HC
Symbol
Car Number

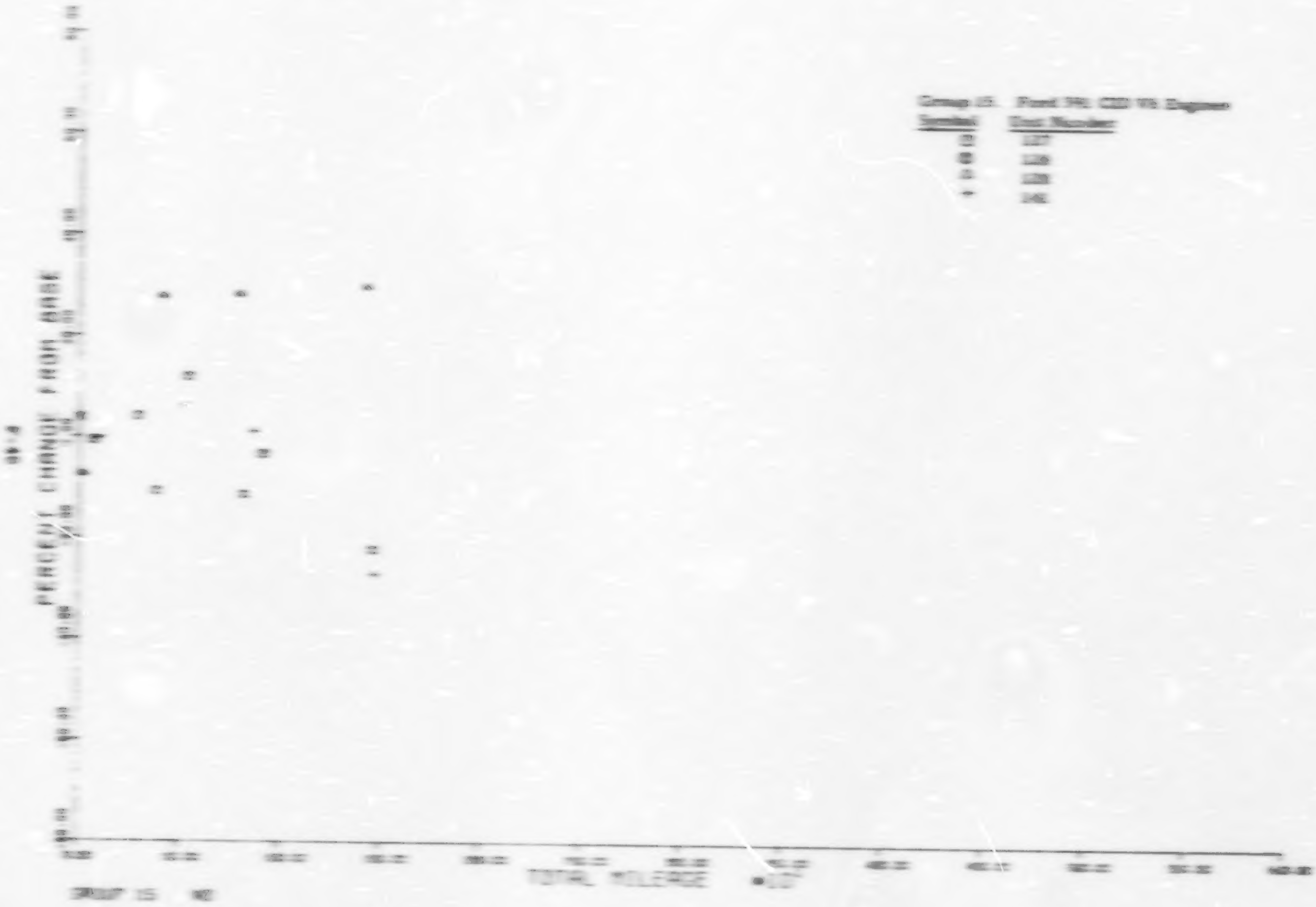

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Unit Number

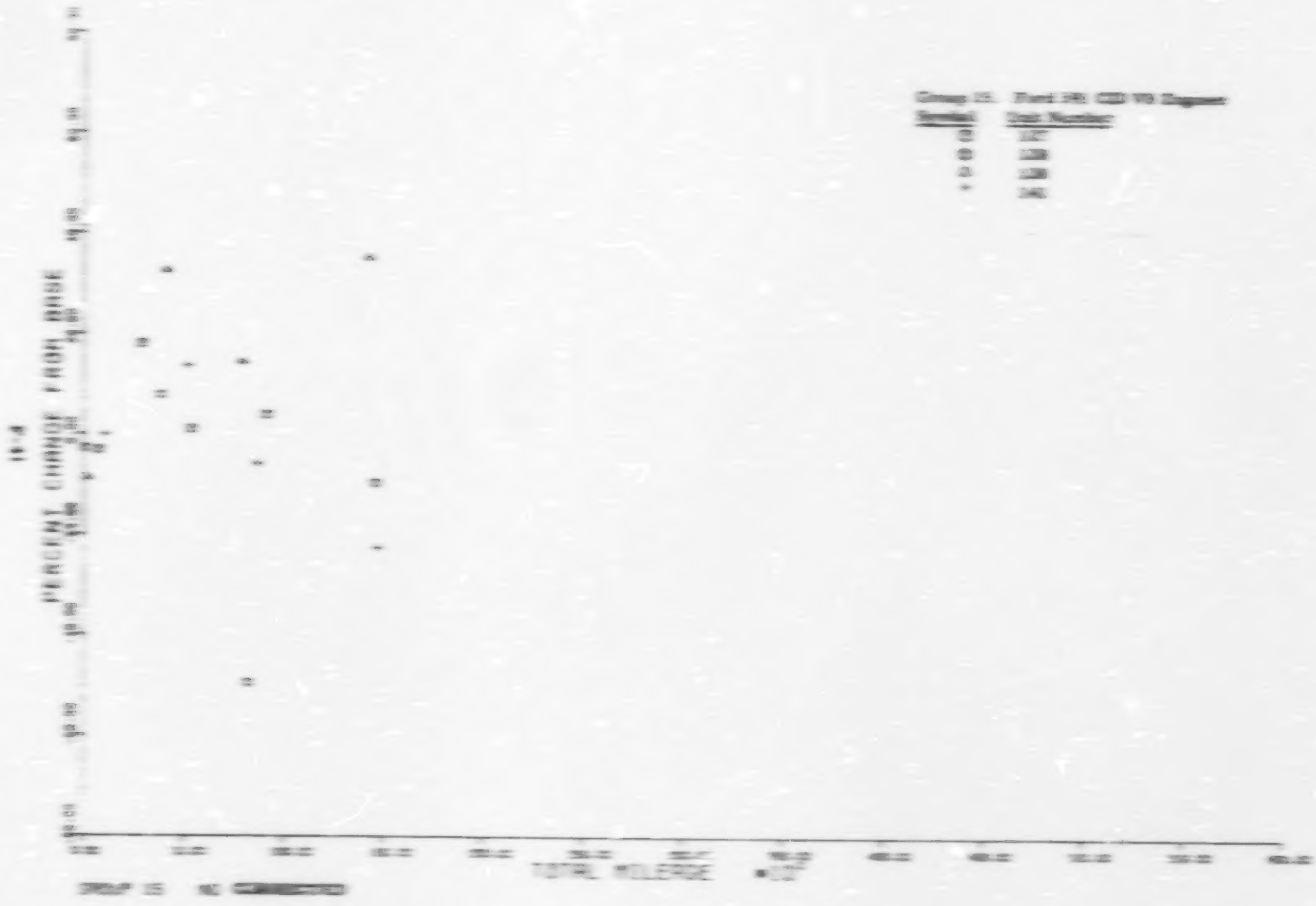

PERCENT CHANGE FROM BASE
TOTAL MILEAGE

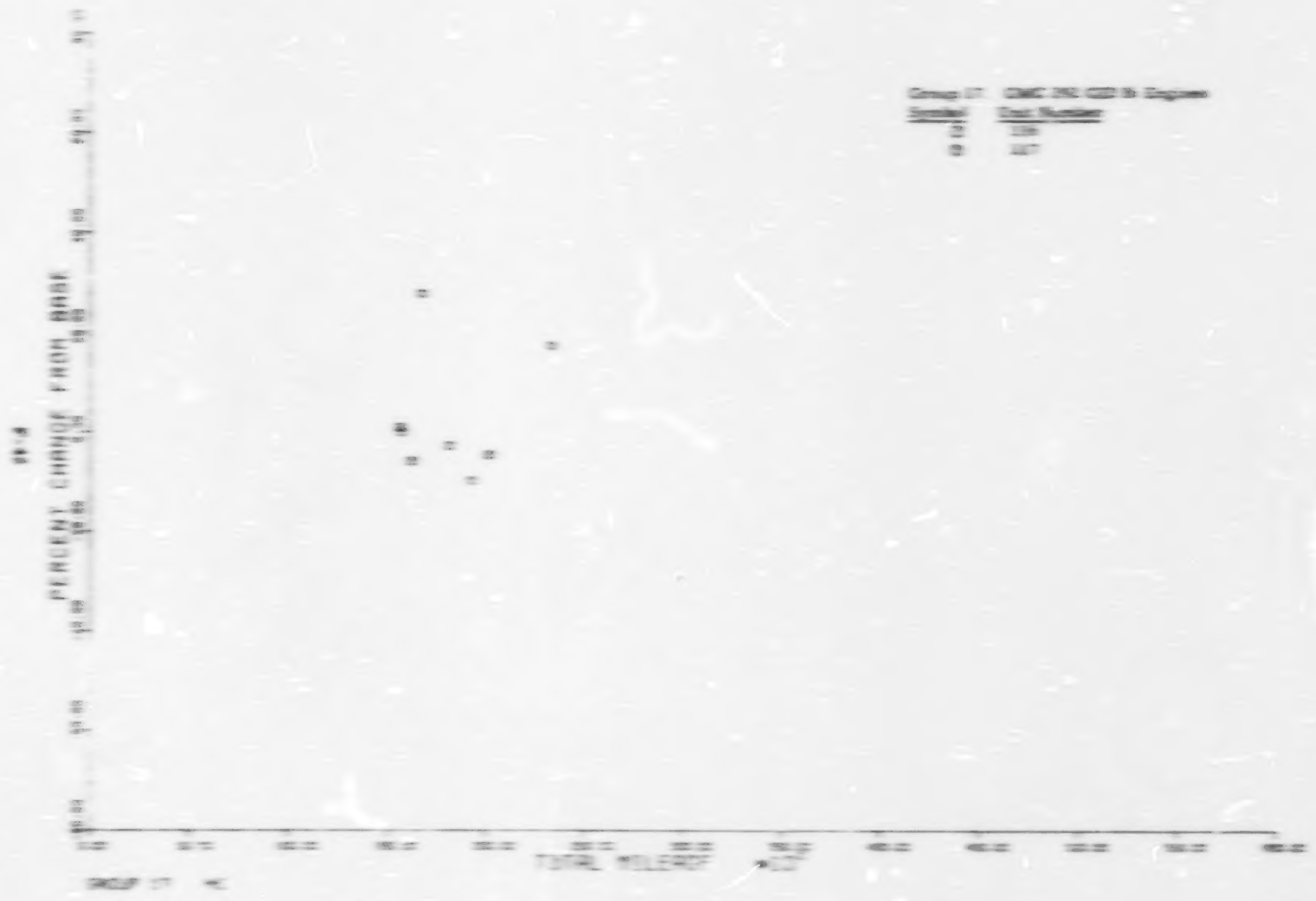

Group 14. Ford 361 CID V8 Engines
Symbol
Unit Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 14

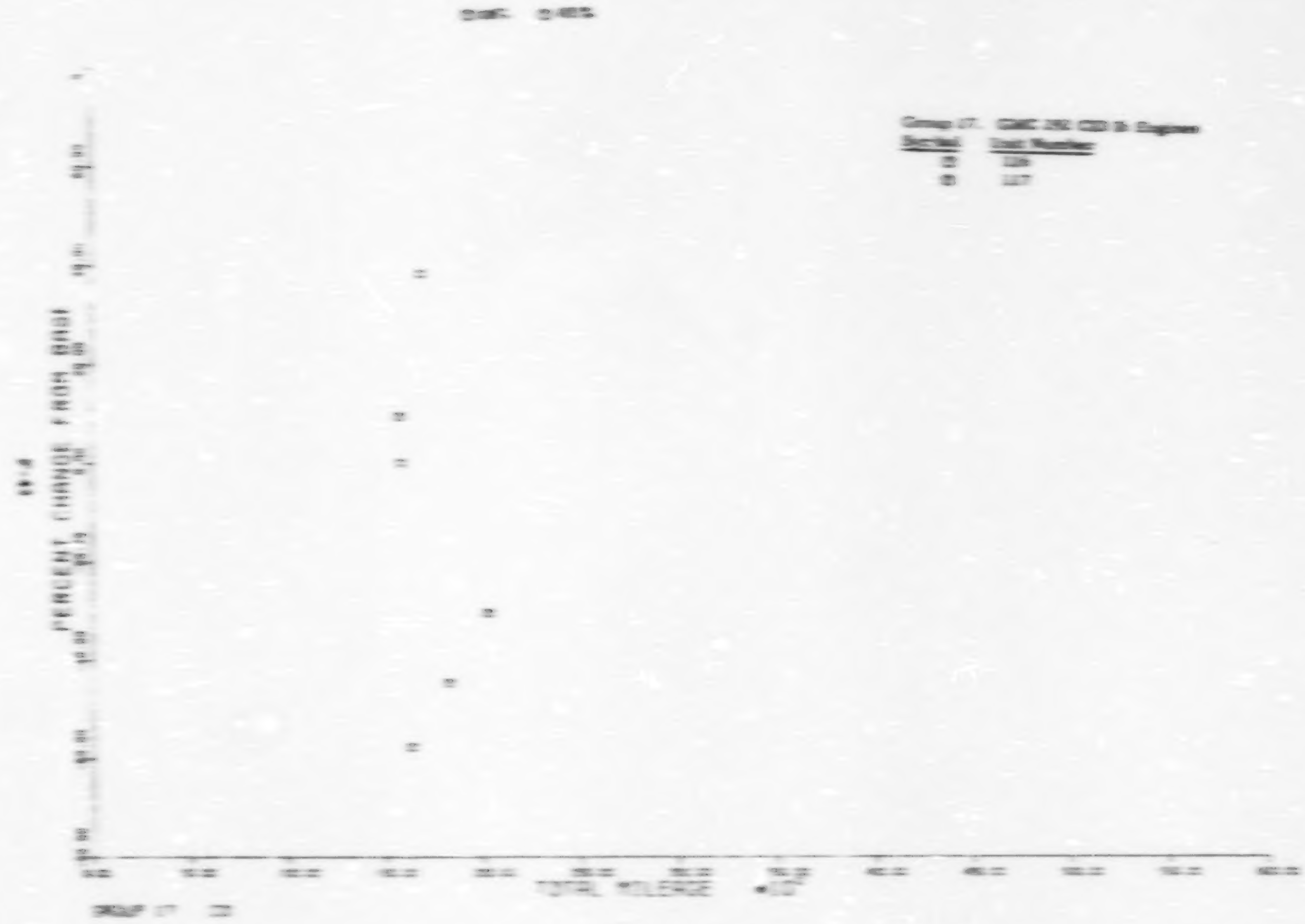

Group 15. Ford 351 CID V8 Engines
Symbol
Unit Number
127
128
129
141
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 15 CO

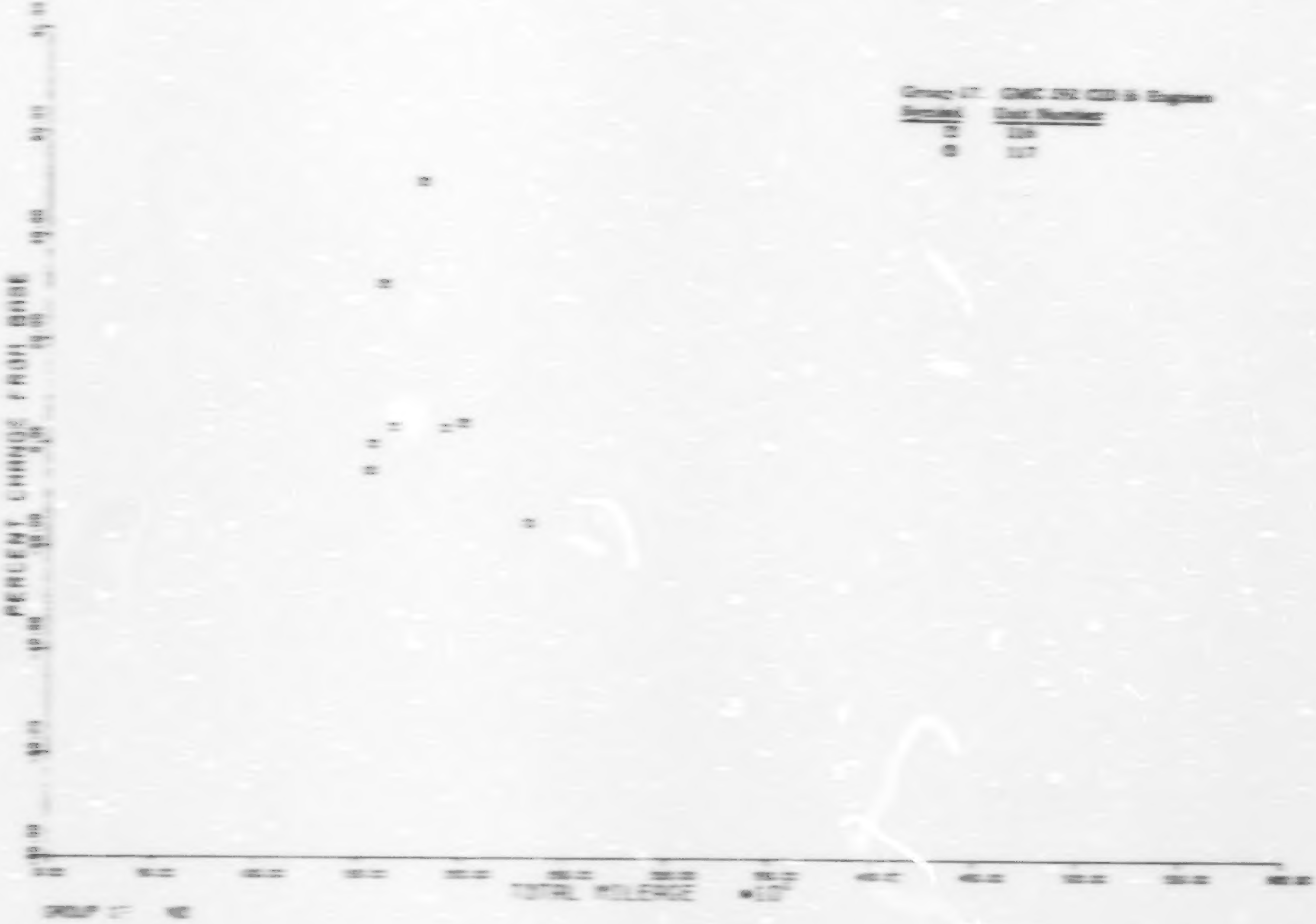

Group 15. Ford 351 CID V8 Engines
Symbol
Unit Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GRP 15 HC

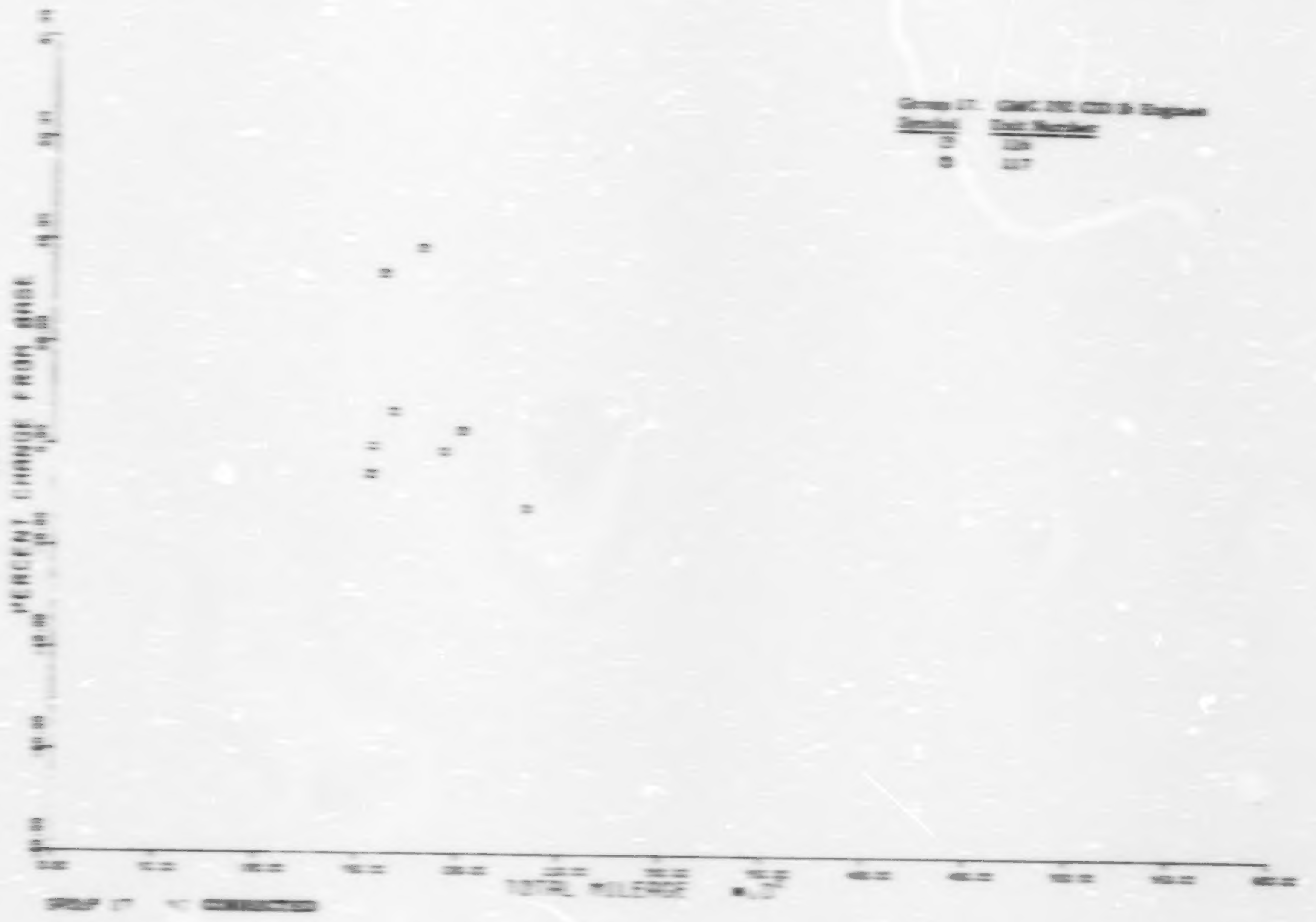

Group 15 Ford 351 CID V8 Engines
Symbol
Unit Number
127
128
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 15

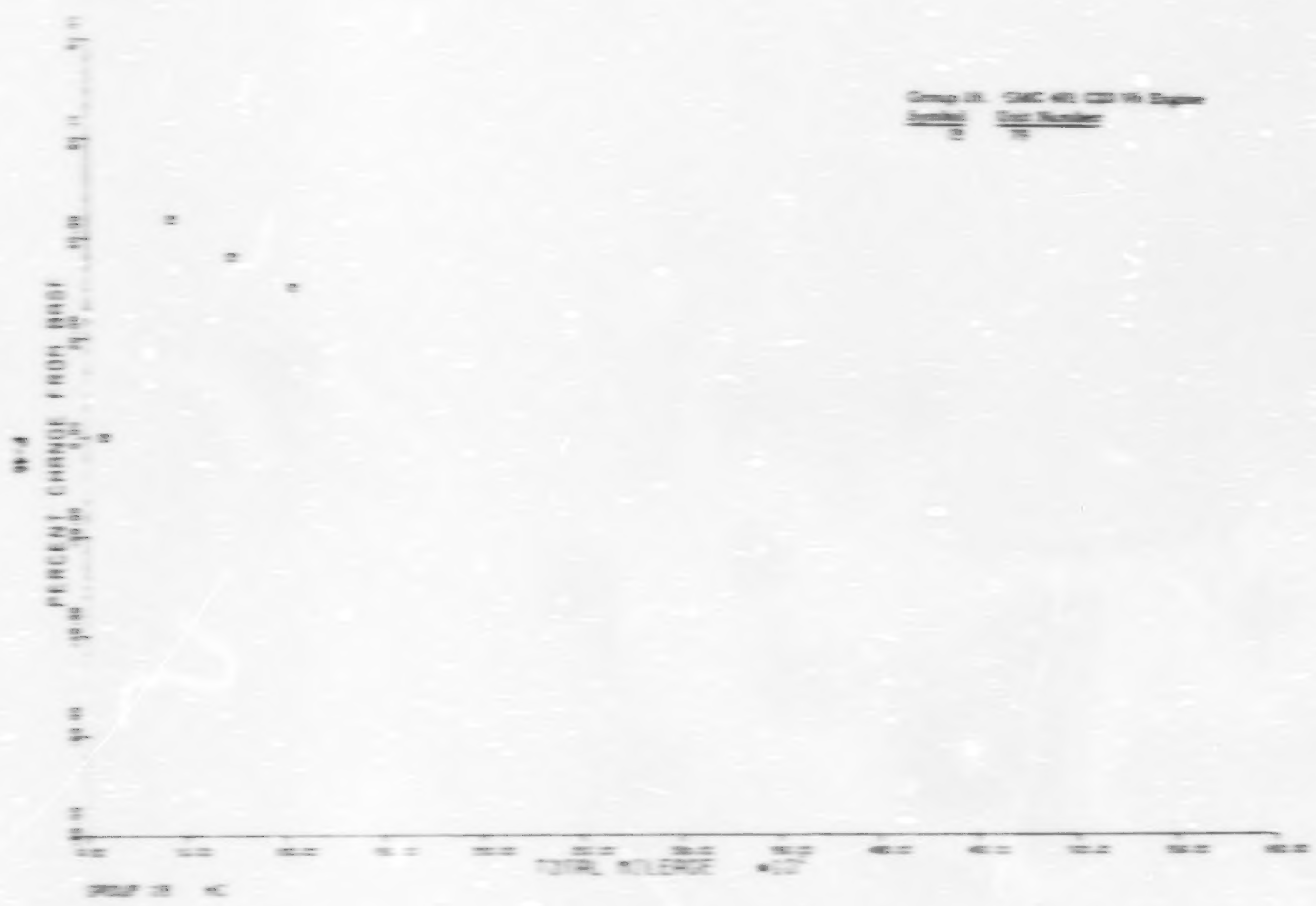
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Unit Number

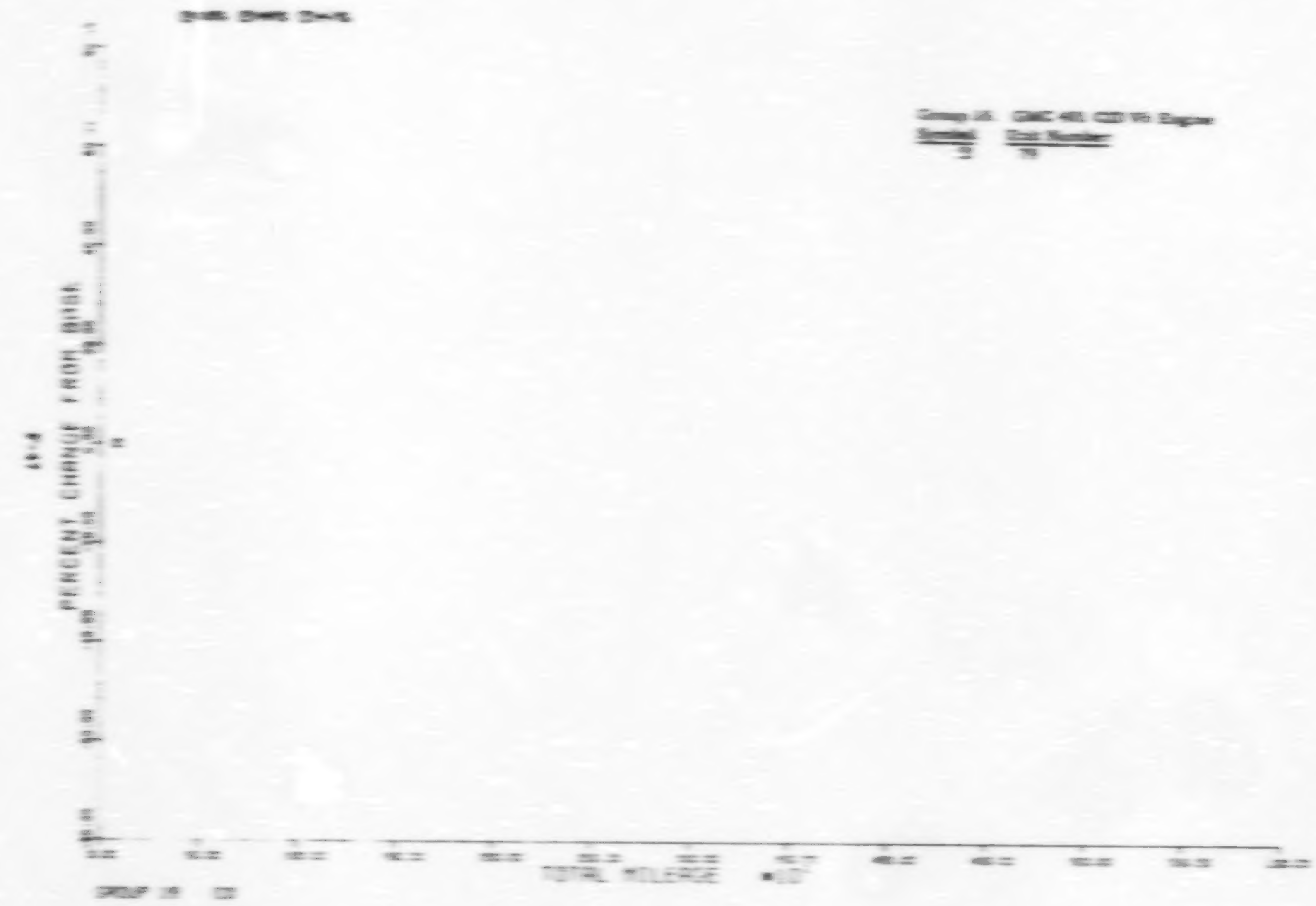
Group 17
Symbol
Unit Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 17 HC

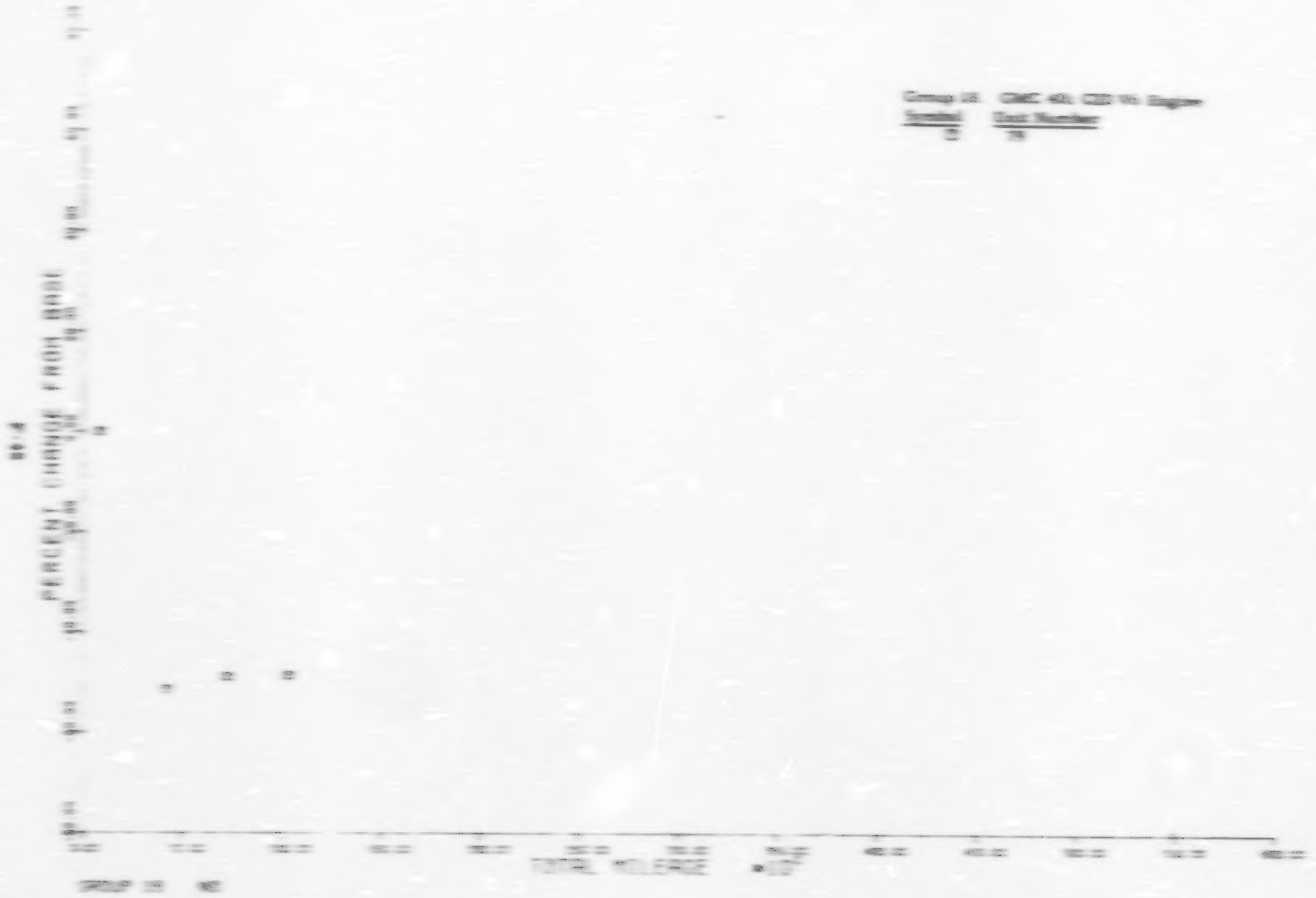

Group 17. GMC 292 CID I6 Engines
Serial
Test Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE *10³

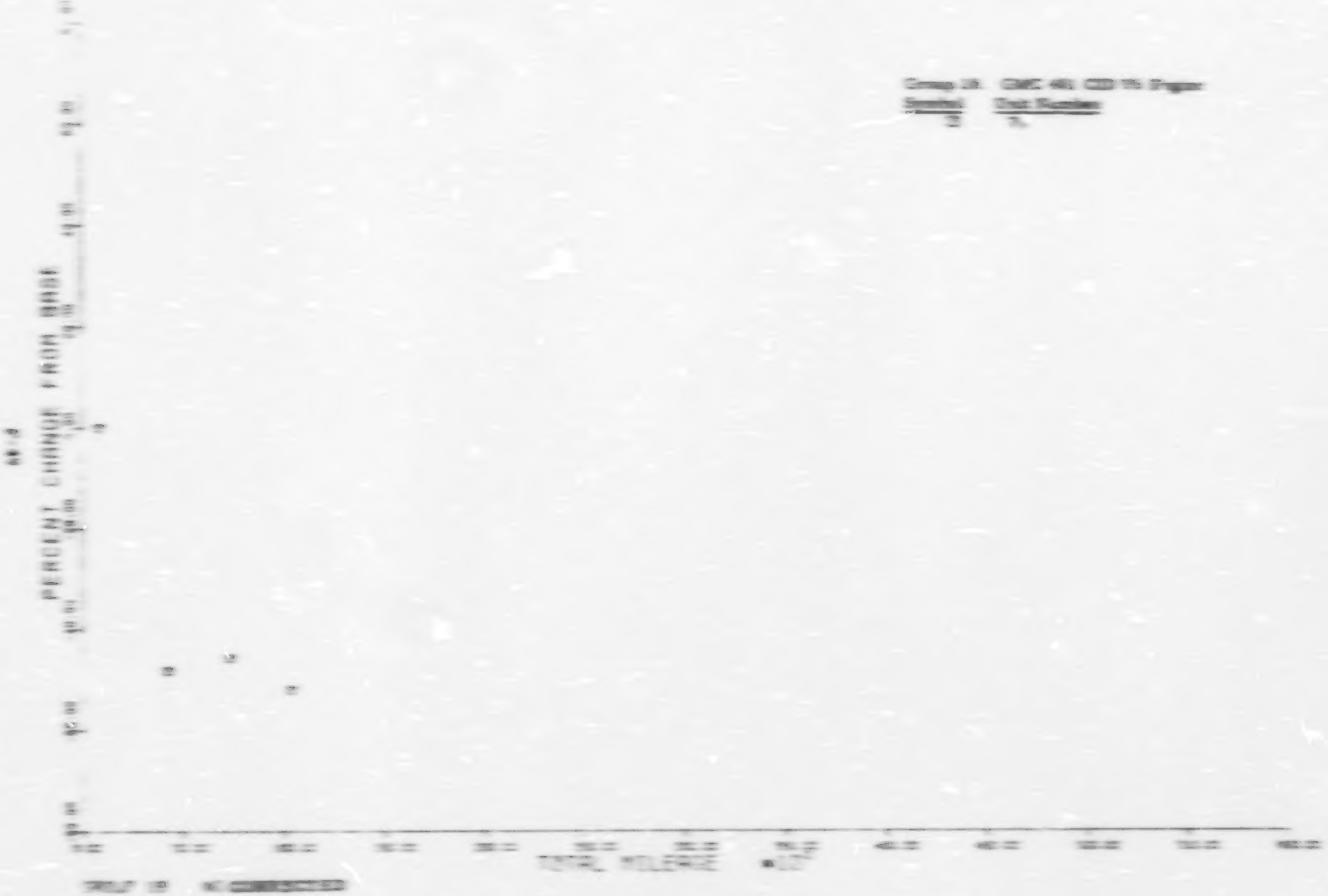

Group 17: GMC 292 CID 6 Engines
Symbol Unit Number
116
117
PERCENT CHANGE FROM BASE
TOTAL MILEAGE *10³
GROUP 17 HC

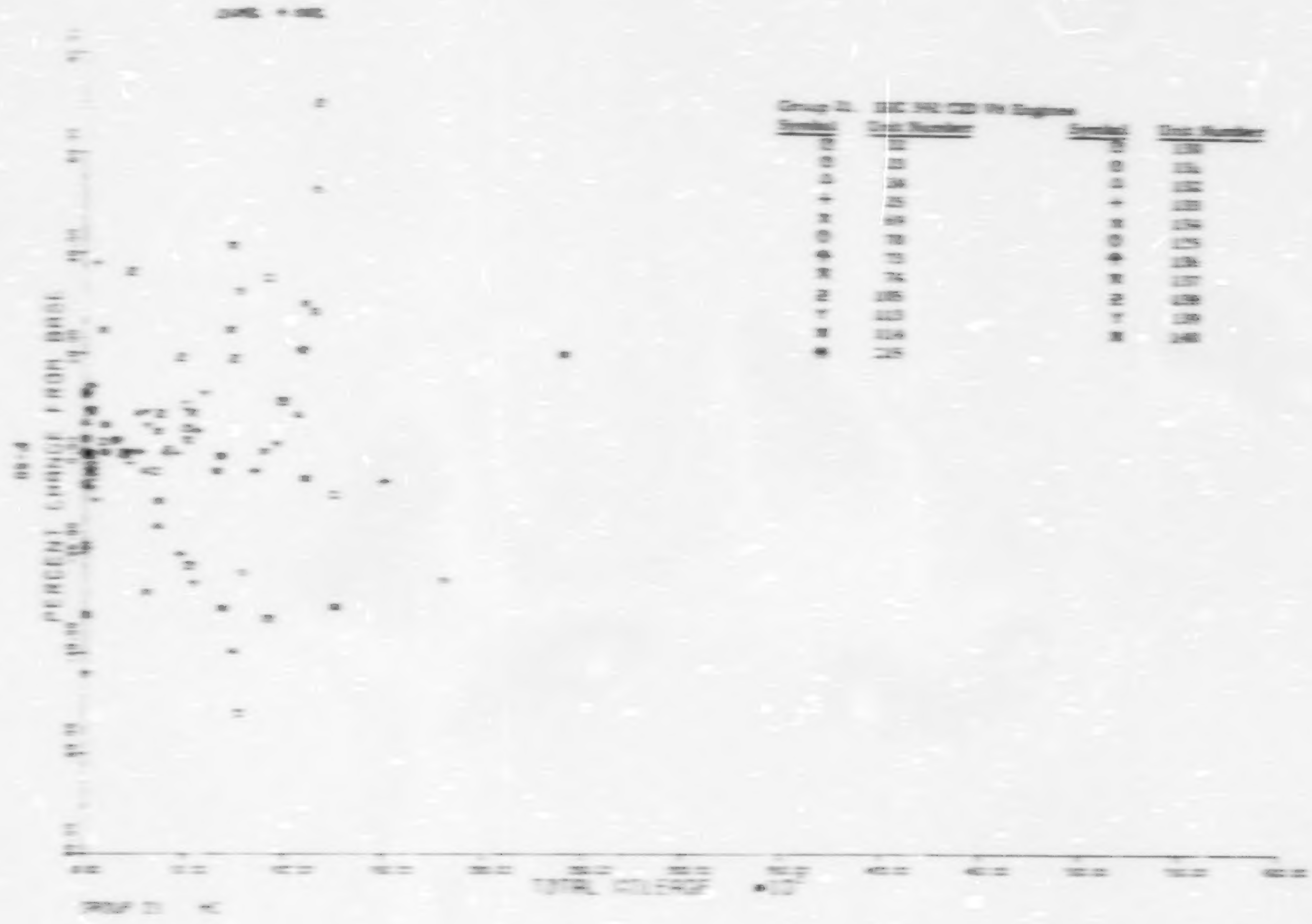

Group 17: GMC [illegible] Engines
Symbol Unit Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE

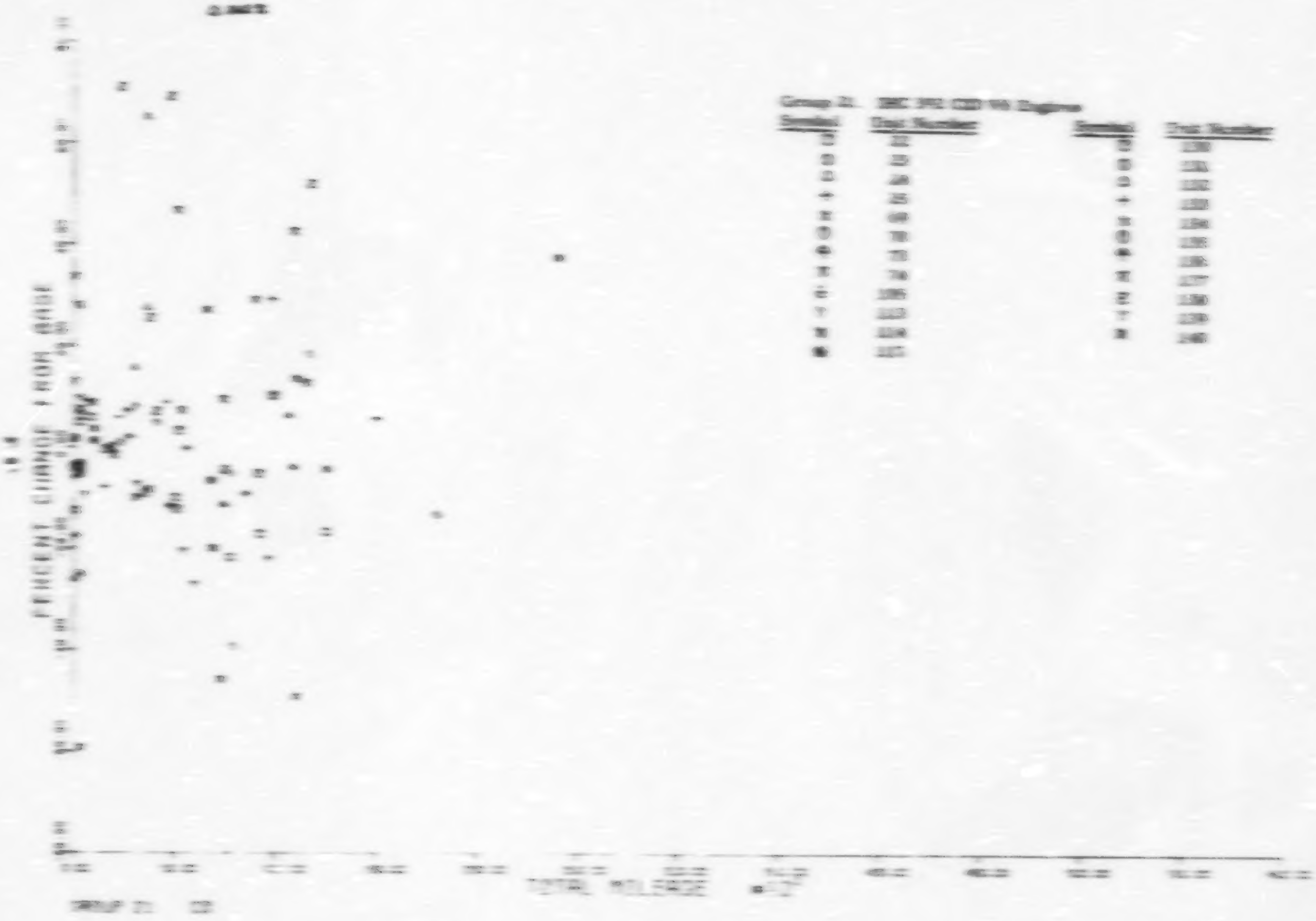

Group 19: [illegible] Engine
Symbol
Unit Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 19 HC

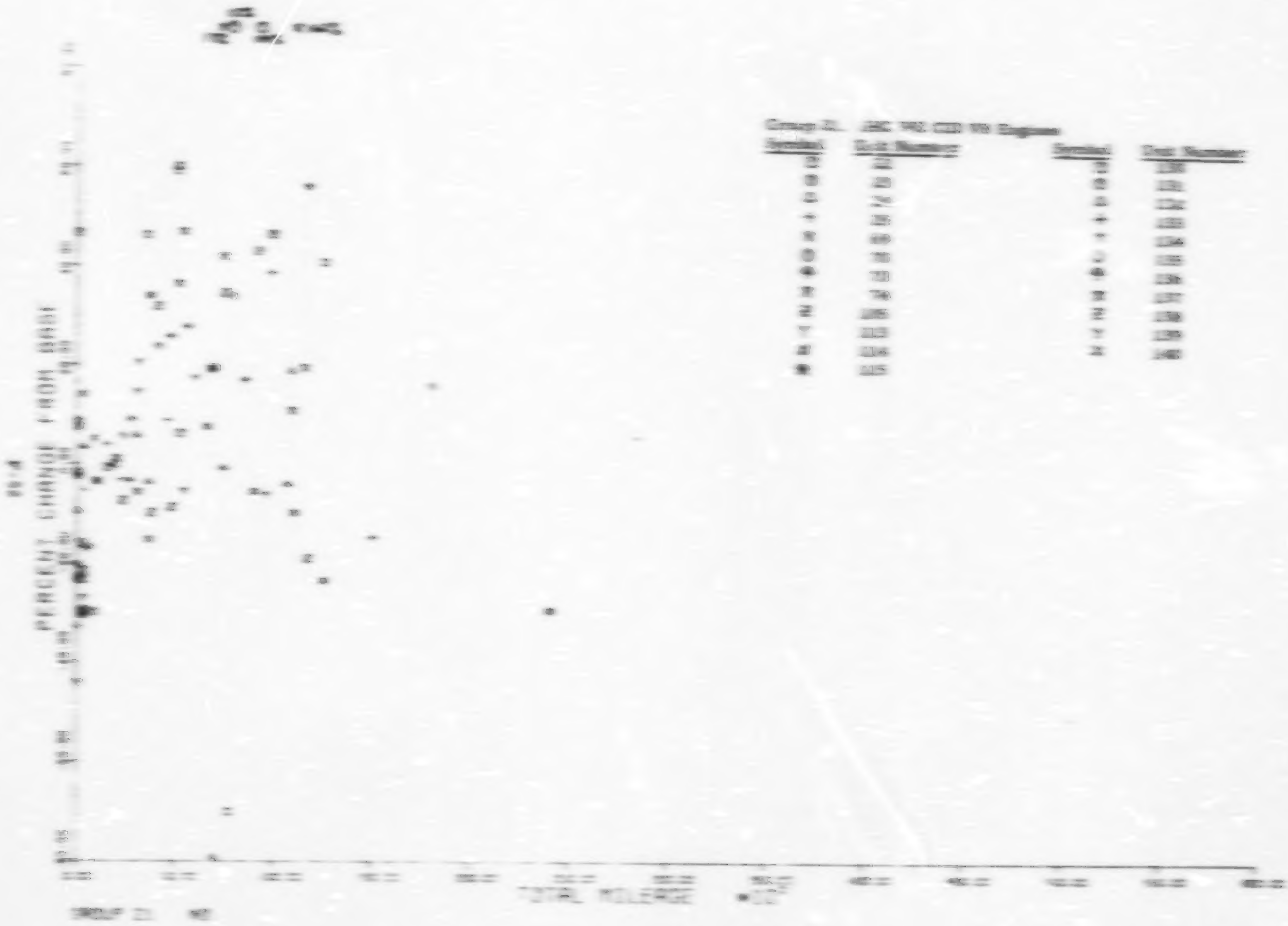

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 16 CO
Group 16 GMC 401 CID V6 Engine
Symbol
Test Number

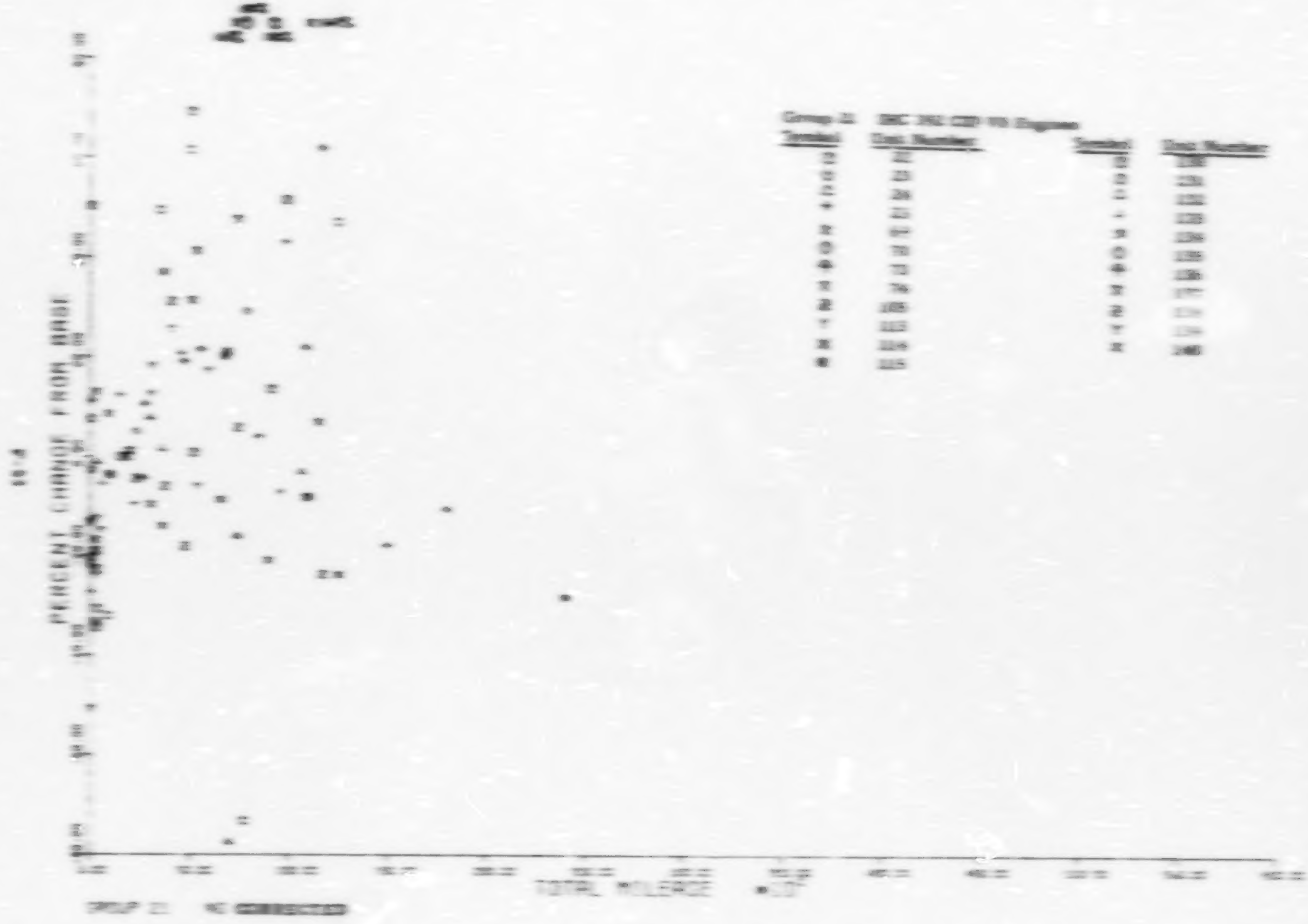

Symbol
Unit Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE

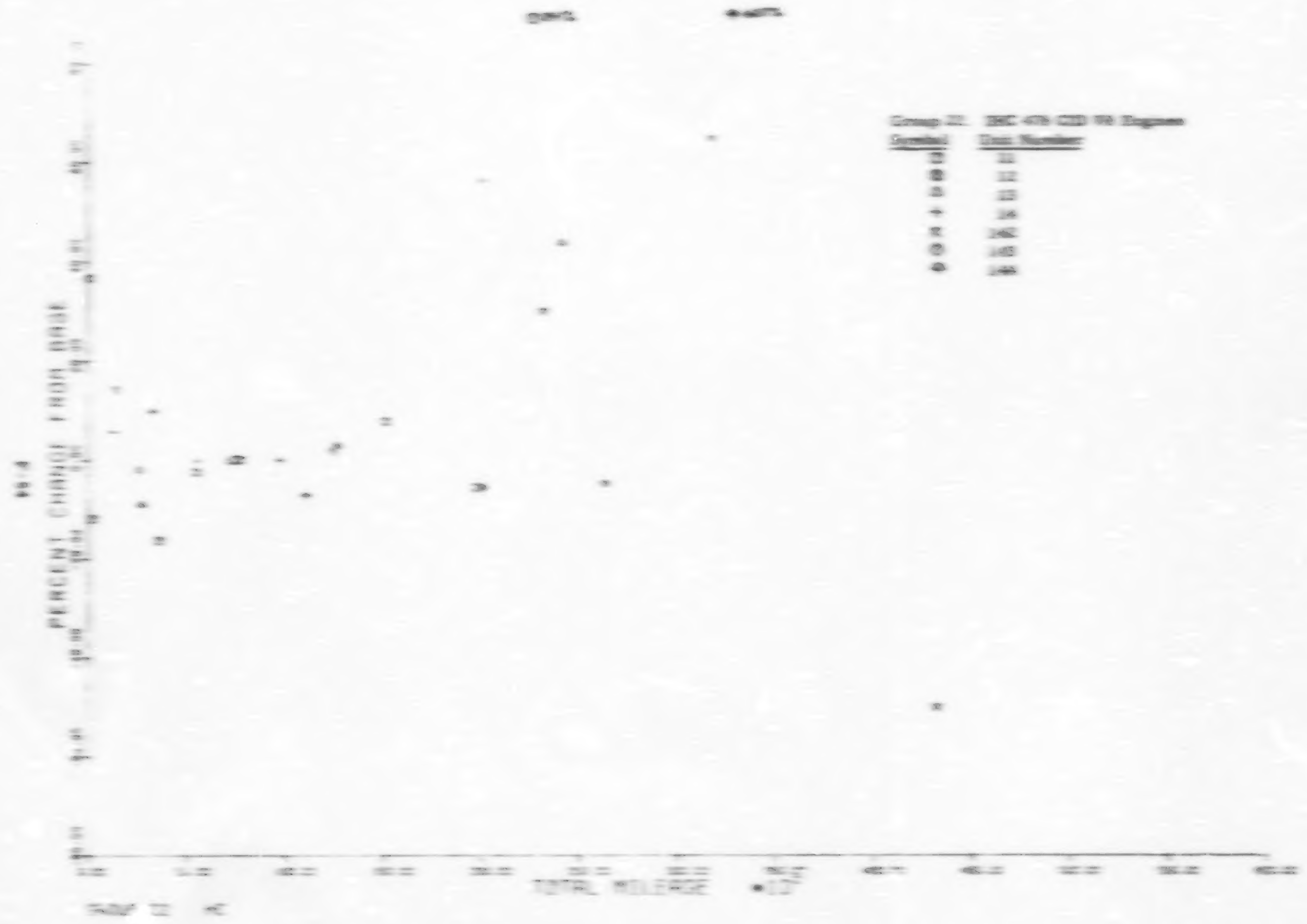

PERCENT CHANGE FROM BASE
TOTAL MILEAGE

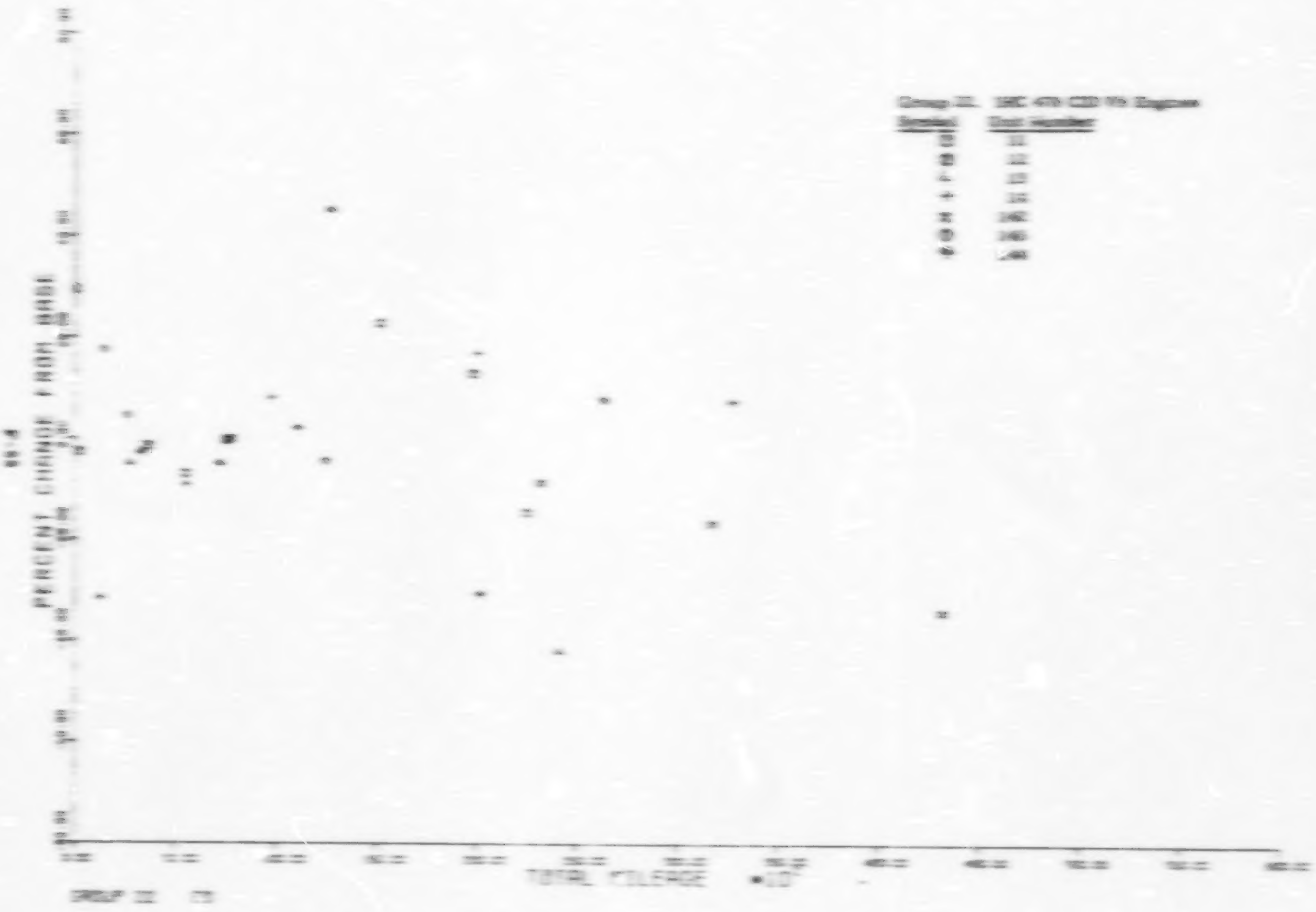

CARB. + HC
PERCENT CHANGE FROM BASE
TOTAL MILEAGE *10³
GROUP 21 HC
Group 21. EEC 392 CID V8 Engines
Symbol
Unit Number
22
23
24
25
69
70
73
74
105
113
114
125
Symbol
Unit Number
130
131
132
133
134
135
136
137
138
139
140

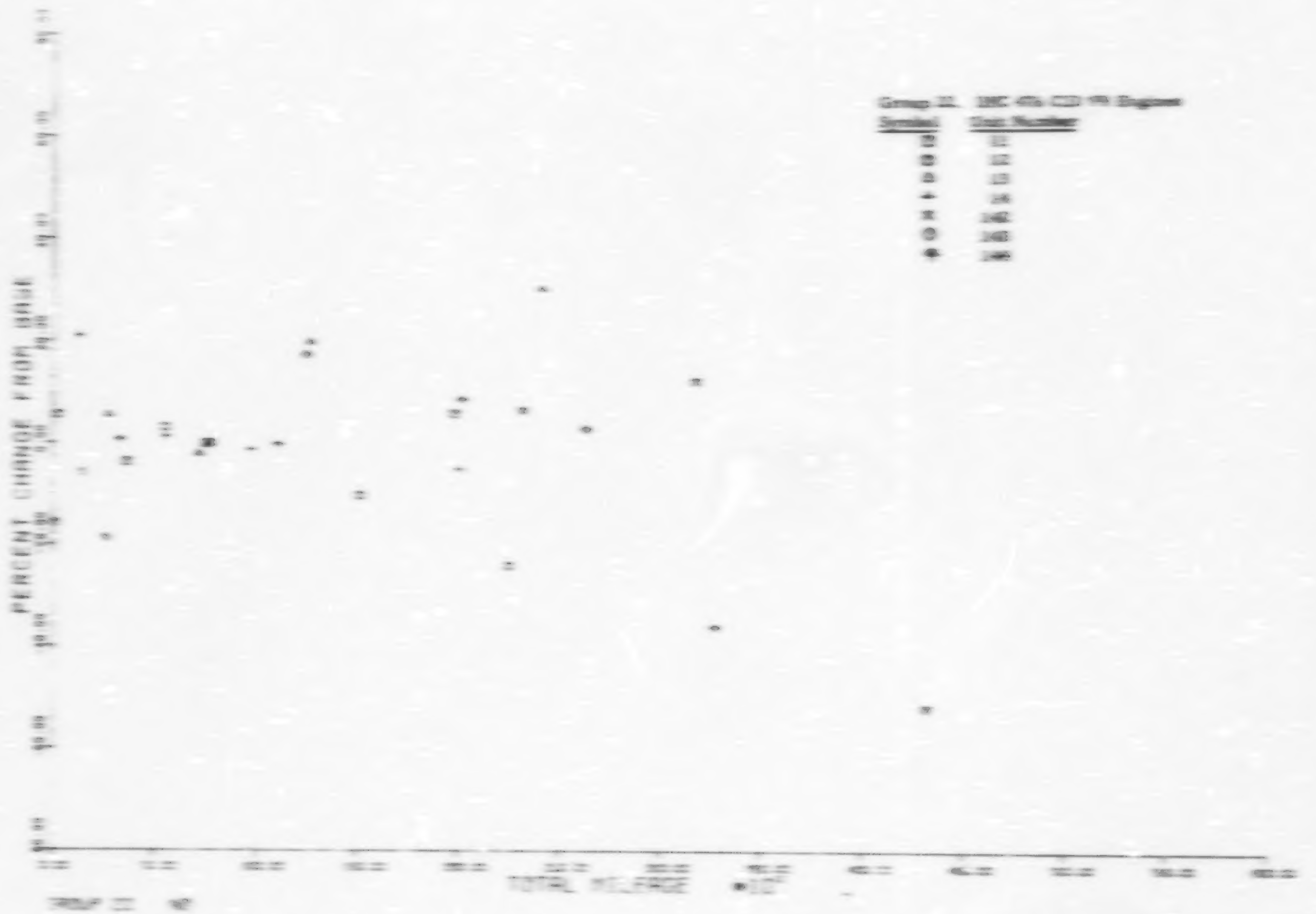

Symbol
Test Number
Symbol
Test Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE

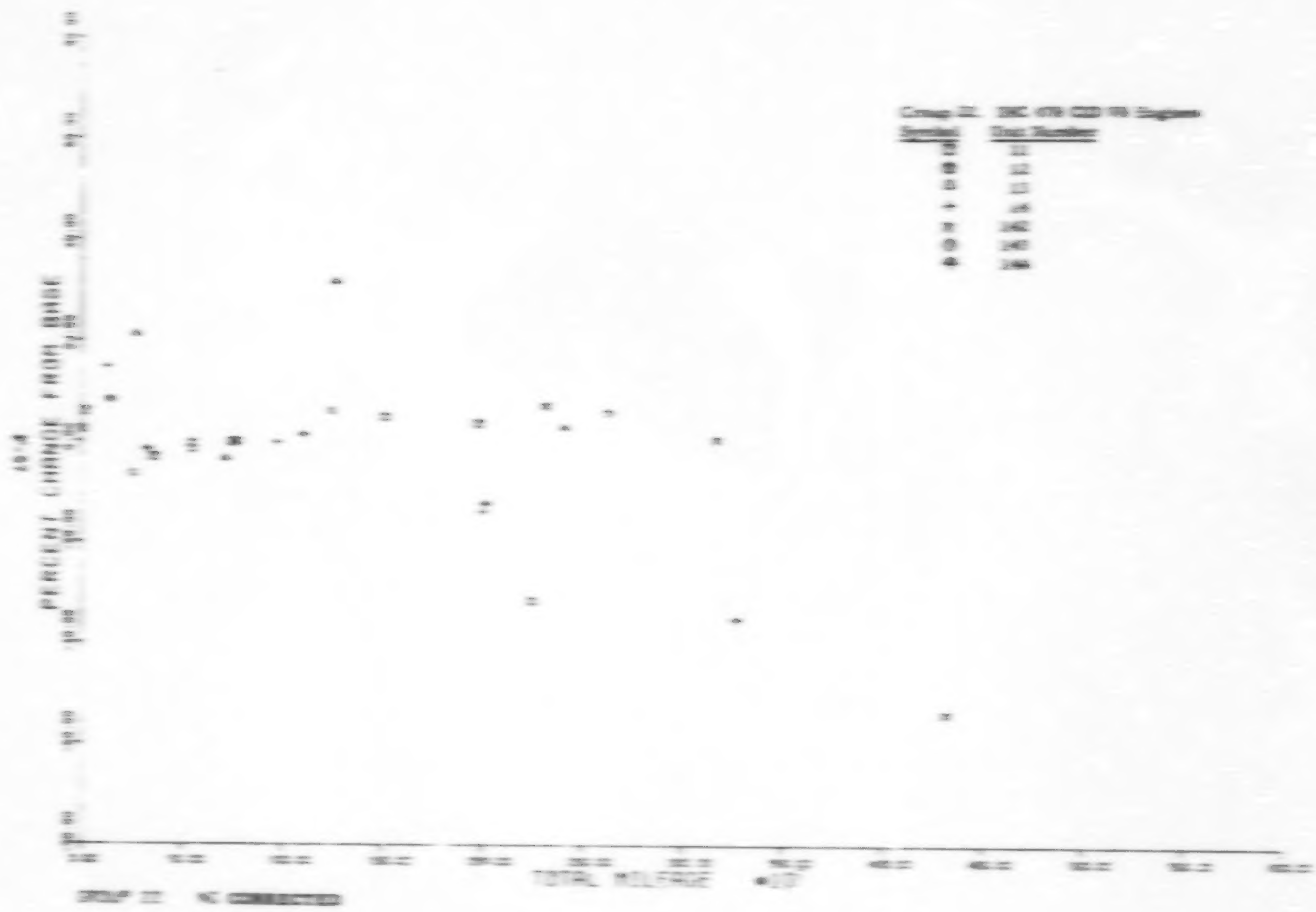

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Unit Number
22
23
24
25
69
70
73
74
105
113
114
115
Symbol
Unit Number
130
131
132
133
134
135
136
137
138
139
140

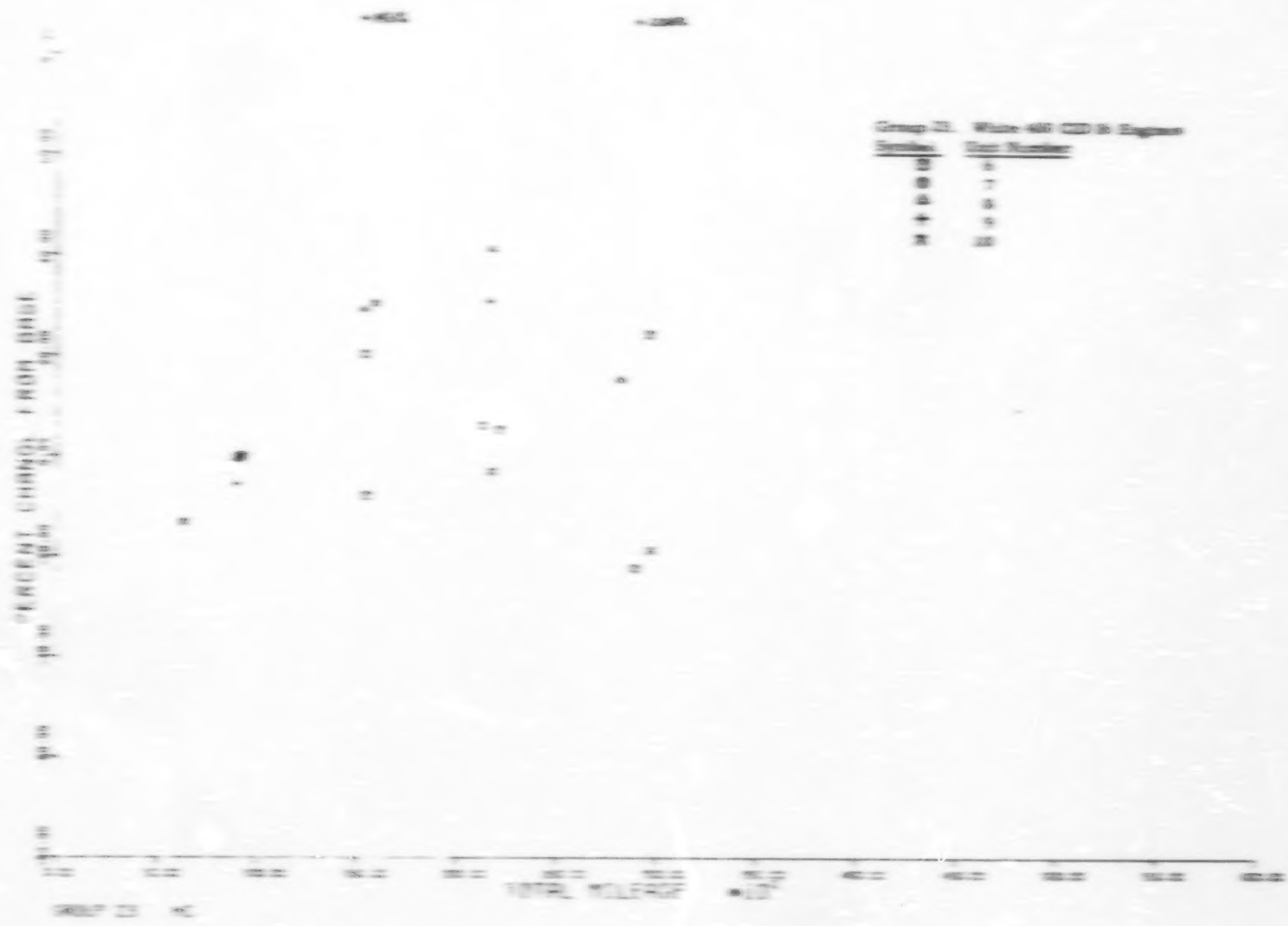
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Car Number
Symbol
Car Number

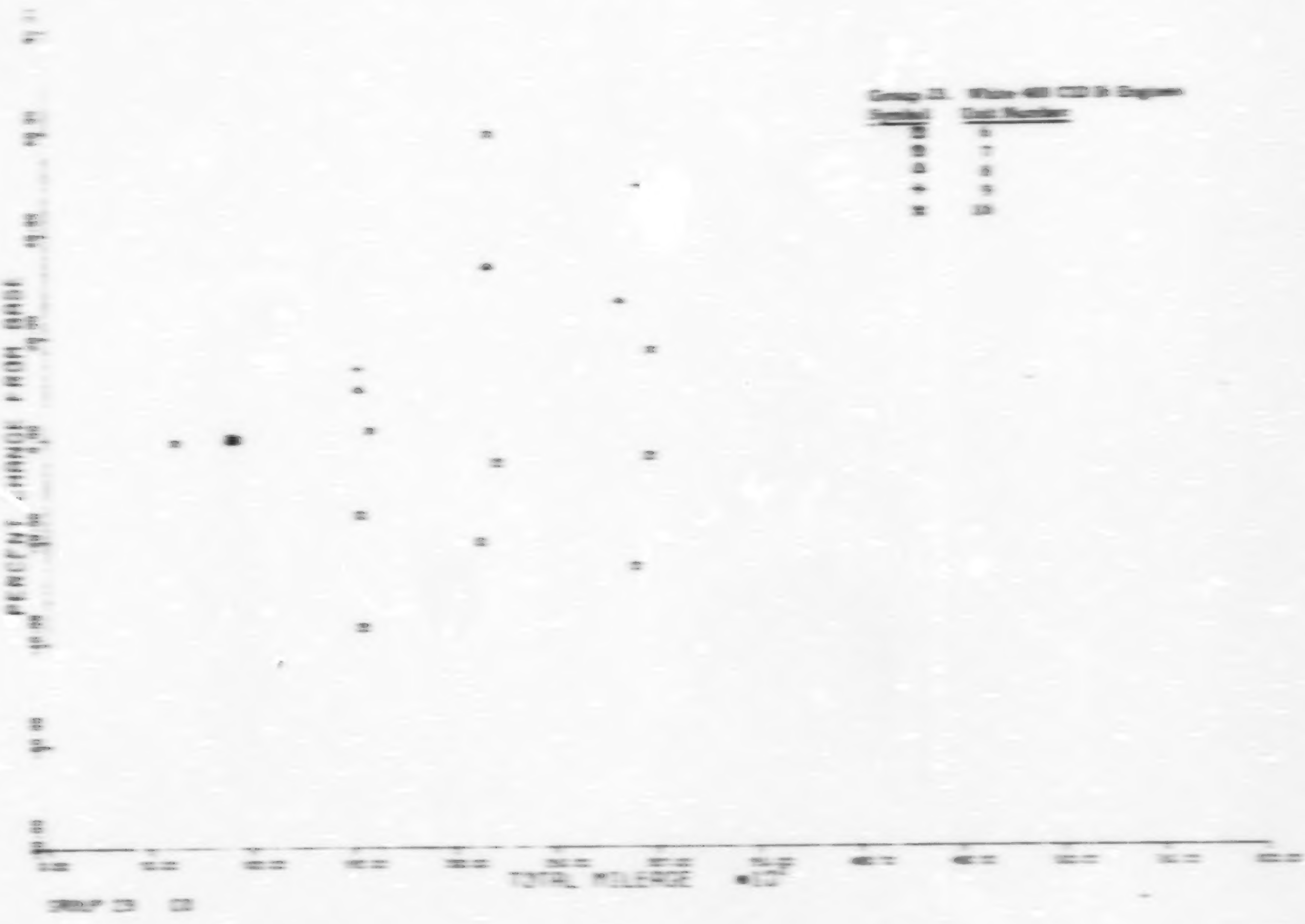

PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Unit Number
11
12
13
14
142
143
144

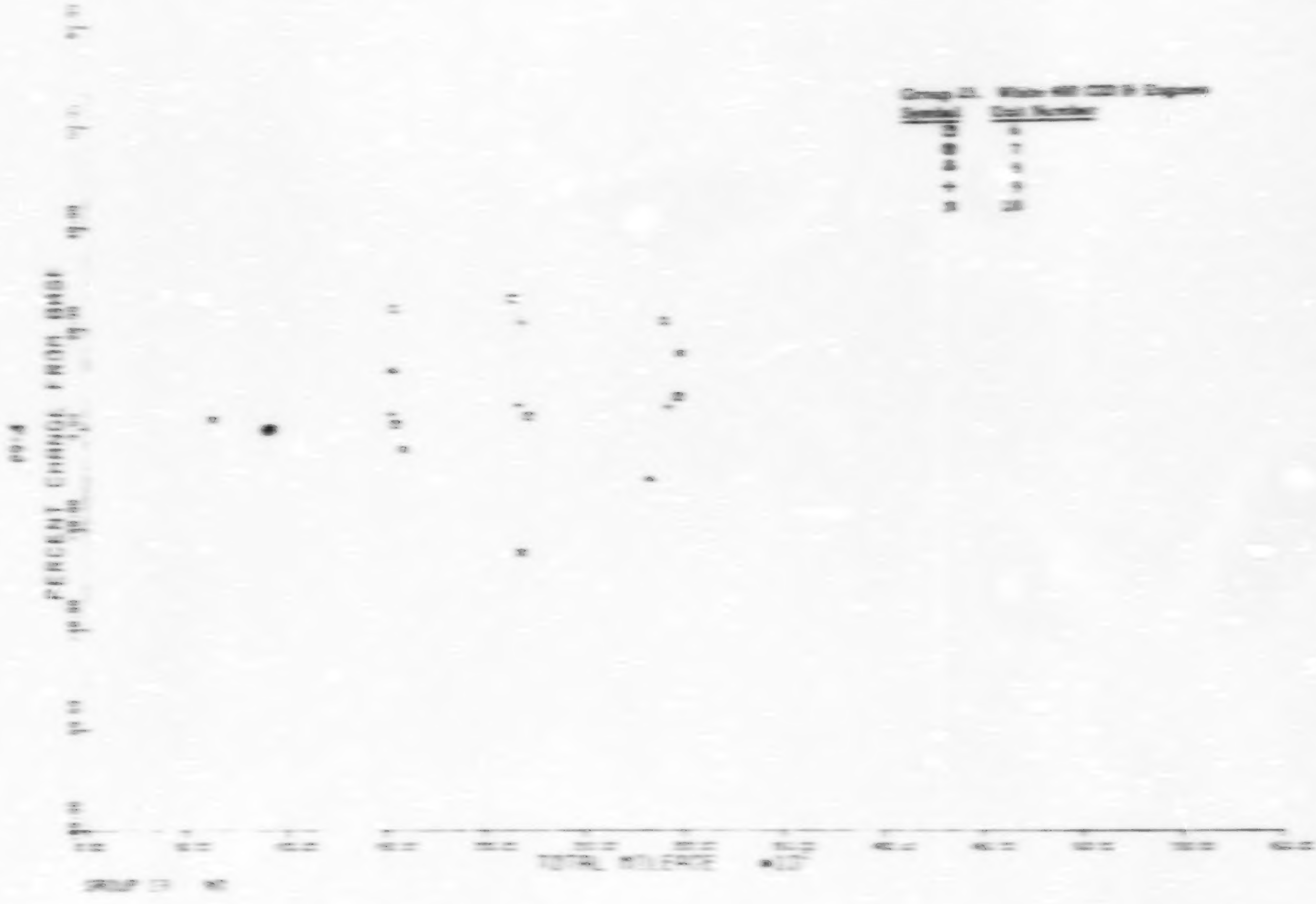

PERCENT CHANGE FROM BASE
TOTAL MILEAGE

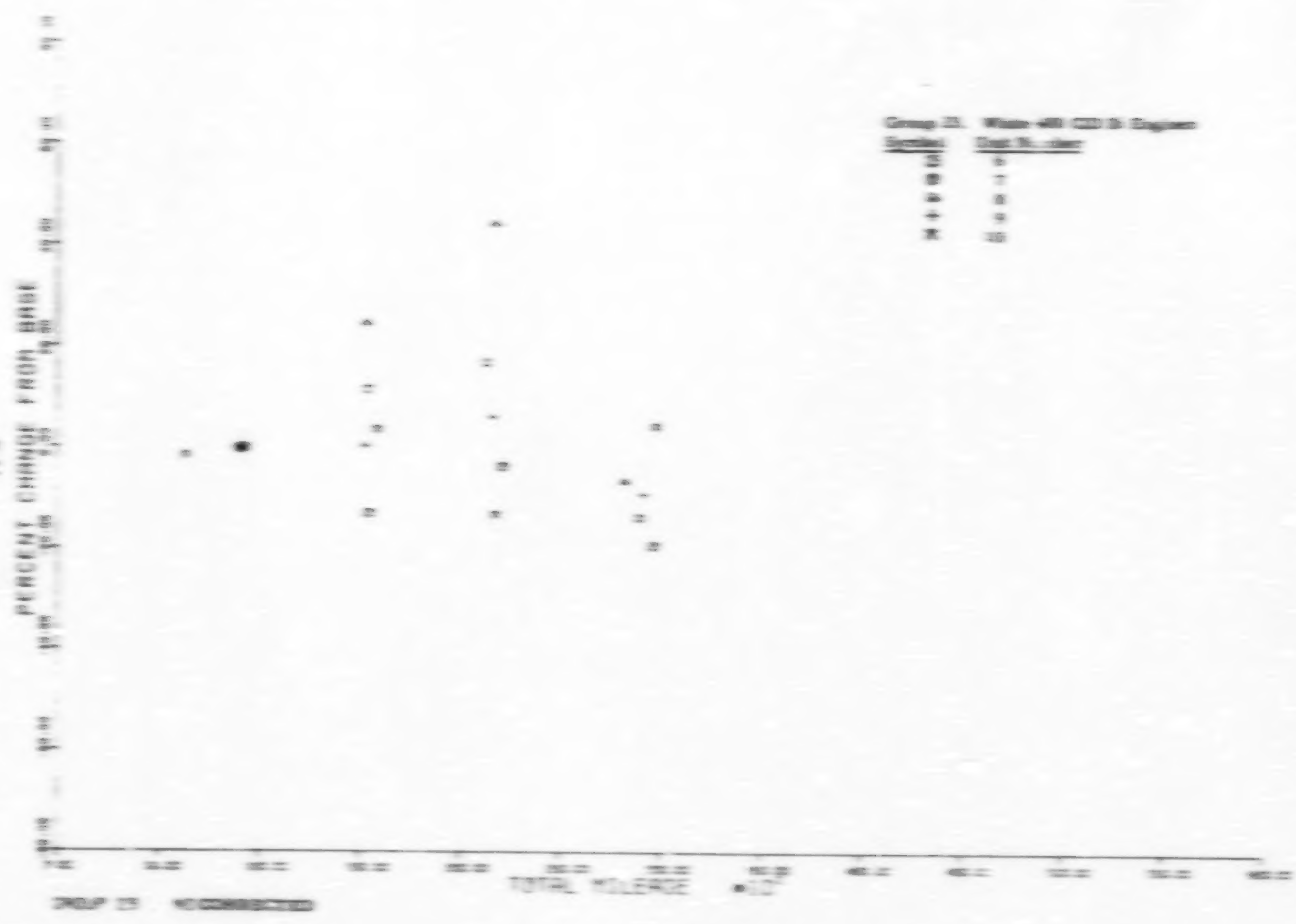

Group II.
Symbol
Unit Number
PERCENT CHANGE FROM BASE
TOTAL MILEAGE


Group 22. [illegible] Engines
Symbol
Unit Number
11
12
13
16
142
143
144
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 22 HC CORRECTED


Group 23. White 460 CID 8i Engines
Symbol
Car Number
6
7
8
9
10
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 23 HC


Group 23. White-400 CID Engines
Symbol
Unit Number
6
7
8
9
10
PERCENT CHANGE FROM BASE
TOTAL MILEAGE
GROUP 23 CO


PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Symbol
Car Number


PERCENT CHANGE FROM BASE
TOTAL MILEAGE
Group 23.
Symbol
Car Number
6
7
8
9
10